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DEPARTMENT OF
WATER AFFAIRS AND FORESTRY
Directorate: National Water Resource Planning

Eastern Region Internal Strategic Perspectives

Mvoti to Mzimkulu Water Management Area

June 2004

Tlou & Matji

DMM

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DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE: NATIONAL WATER RESOURCE PLANNING

INTERNAL STRATEGIC PERSPECTIVE:
MVOTI TO MZIMKULU WATER MANAGEMENT AREA

Version 1: June 2004

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE NATIONAL WATER RESOURCE PLANNING

INTERNAL STRATEGIC PERSPECTIVE

MVOTI TO MZIMKULU WATER MANAGEMENT AREA

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INVITATION TO COMMENT
This report will be updated on a regular basis until it is eventually superceded by the Catchment Management Strategy. Water users and other stakeholders in the Mvoti to Mzimkulu WMA and other areas are encouraged to study this report and to submit any comments they may have to the Version Controller (see box overleaf).

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EXECUTIVE SUMMARY

1. INTRODUCTION

This Internal Strategic Perspective (ISP) aims to ensure synergy within the Department of Water Affairs and Forestry (DWAF) regarding water resources management in the Mvoti to Mzimkulu WMA. The ISP presents a common and consistent departmental approach to guide officials when addressing water management related queries and evaluating water licence applications.

2. BACKGROUND AND APPROACH

Water is one of the key and most fundamental and indispensable of all our natural resources. It is fundamental to life (and the quality of life), the environment, food production, hygiene, industry, and power generation. Water can be the limiting factor when it comes to economic growth and social development, especially in South Africa where it is a relatively scarce resource that is distributed unevenly both geographically and through time as well as socio-politically. Prosperity for South Africa depends upon sound management and utilisation of our many natural and other resources, with water playing a pivotal role.

DWAF is striving for an integrated planning and management approach, referred to as Integrated Water Resource Management (IWRM). The ultimate aim of this IWRM process is to arrive at:

- an allocation schedule that meets the requirements of the National Water Act (NWA) (Act 36 of 1998);
- water resources yield and other models that are representative of the flow regime of the river systems in the area;
- management class scenarios for the river (i.e. Reserve and Resource Quality Objectives set);
- a Catchment Management Strategy.

These deliverables can only be finalised once the Catchment Management Agencies (CMA) assume responsibility for managing the water resources of their respective Water Management Areas (WMA). In the interim, DWAF's Regional Offices will continue to manage the water resources in their area of jurisdiction until such time as they can hand over these management functions to established and fully operational CMAs. In accordance with the NWA, DWAF (the Minister) will still remain ultimately responsible for the management of the water resources.

In light of this responsibility, DWAF's corporate perspective (including all relevant Directorates in the Department) on how the water resources should be managed needs to be formally expressed in order to manage the water resources in a consistent and predictable manner. The purpose of the ISP is to document these perspectives and offer sound motivation to demonstrate proper and reasonable governance.

3 OVERVIEW OF THE MOVTI TO MZIMKULU WMA

The Mvoti to Mzimkulu WMA covers the U, T40 and T50 drainage regions, as defined in the Water Resources 90 reports (Midgeley, et al, 1994). The WMA consists of two large river systems (Mzimkulu and Mkomazi), two medium-sized river systems (Mgeni and Mvoti) and several smaller river systems (e.g. Mzumbe, Mdloti, Tongaat, Ifafa, Lovu). A map showing the location of the WMA is provided in **Figure 2.1.** The larger rivers rise in the Drakensberg, the medium rivers in the Natal Midlands and the smaller rivers close to the coast. The medium-sized rivers rising in the Natal Midlands have been largely modified by human activities, mainly intensive agriculture, forestry and urban settlements.

The WMA stretches from the Drakensberg mountains in the west at an altitude of over 3 000m and drops to sea level in the east over a comparatively short distance of 150 km. The WMA is very rugged. It is characterised by steep slopes in the river valleys and in the Drakensberg mountains where the two big rivers, the Mkomazi and Mzimkulu rise. Very steep slopes characterise the river valleys in the inland areas for all rivers and where small streams like the Mtwalume rise. Areas of moderate slopes are found but comprise only 3% of the area of the WMA. These flatter areas are mainly subject to intensive agricultural activities.

The Key Areas are:

- Mvoti (Tertiary catchments U40 and U50);
- Mdloti (Tertiary catchment U30);
- Mgeni (Tertiary catchment U20);
- Mlazi and Lovu (Tertiary catchments U60 and U70);
- Mkomazi (Tertiary catchment U30);
- South Coast (Tertiary catchment U80);
- Mtamvuna (Tertiary catchment T40); and
- Mzimkulu (Tertiary catchments T51 and T52).

The Mvoti Key Area

Land use in the Mvoti Key Area consists mostly of communal land inland (Mapamulo), commercial timber in the upper reaches of the catchment, dryland and irrigated sugar cane along the coastal strip, and urban areas of Stanger and Greytown.

The water resources of the Mvoti catchment are poorly developed and have not kept pace with the water requirements. As a result the requirements far exceed the available resources and the catchment can be considered to be stressed. Water resources development for future scenarios in the Mvoti catchment could take the form of dam development on the Mvoti River, increased supply from Hazelmere Dam or the possible development of the alluvial aquifers in the lower Mvoti River. These options need to be considered in more detail. Improved operating rules of Lake Merthley and boreholes, coupled with catchment management activities such as the removal of invasive alien plants would delay the immediate requirements of new water resources schemes. Several small dam sites have also been investigated for augmenting Greytown's water supply.

There is no scope for further water allocation in the Mvoti catchment unless accompanied by the provision of storage or additional transfers into the catchment, both of which are feasible options. No decision has yet been made on which augmentation option to implement.

A significant portion of the water allocations as well as dryland sugar cane in the Mvoti Key Area are in the hands of emerging farmers. While accurate figures on this are not available, the situation will need to be understood better before considering reallocation for poverty eradication purposes.

The Mdloti Key Area

Land use in the Mdloti Key Area consists mostly of dryland and irrigated sugar cane, mostly on communal land. The small urban areas of Tongaat, Canelands, Verulam and Umhlanga are located in this Key Area. Water is transferred out of the catchment to the Mvoti catchment.

There is a surplus available in this Key Area which could be allocated for poverty eradication, but as a first priority water for the increase in urban requirements must be planned for and secured. Considering the severely stressed nature of the Mvoti Key Area, surpluses in the Mdloti catchment could be used to augment the water supply to the Mvoti. This needs to be weighed up against the alternative of developing the resource in the Mvoti catchment. Water resources development in the Mdloti catchment is possible through the raising of Hazelmere Dam and this is the intended source of water to meet increasing urban requirements along the North Coast.

The water quality of the catchment is generally poor due to point source pollution, especially along the coastal strip. The inland regions generally enjoy better water quality but erosion and resultant sedimentation is a problem. However, the point sources of pollution problems are known and DWAF's regional office is addressing these.

The Mgeni Key Area

The catchment is currently serviced by the four major dams on the Mgeni River - Midmar, Nagle, Albert Falls and Inanda dams, and the Mooi-Mgeni transfer scheme. The water requirements in the Key Area are currently approximately in balance with the available yield but due to the currently low level of storage in the Mgeni system, the risk of water restrictions within the next three years is unacceptably high.

Future dam construction and associated transfer schemes have been identified in the form of Spring Grove Dam on the Mooi River, Smithfield and Impendle dams on the Mkomazi River. The construction of major new infrastructure (dams and transfer schemes) on the Mooi and Mkomazi rivers to meet the future needs of Pietermaritzburg and Durban requires that the water in these catchments be reserved for this future use. Allocations in these catchments must therefore be constrained with this in mind.

Durban, the biggest demand centre in the catchment, has successfully implemented WC&DM initiatives, resulting in reduced demands. These have

been achieved through effluent reuse and water-loss management. A 50 Ml/day (18 million m^3/a) recycling plant is operational and supplies the southern industrial zone. Further WC&DM measures are planned. Nevertheless, the situation in the Mgeni Key Area is precarious and needs to be carefully monitored and tight control over WC&DM maintained.

Water quality in the lower Mgeni River and in the Msunduzi River is generally poor. This is due to the dense human population in and around Durban and Pietermartizburg, some of which is not serviced with adequate sanitation.

The Mlazi and Lovu Key Area

The catchment is dominated by irrigation (59 km^2) and afforestation (308 km^2), with irrigation by far the dominant water user. Much of this irrigation use is for intensive vegetable farming to supply Durban and Pietermaritzburg. This is important from a food supply perspective.

The catchment is largely unregulated. However, large farm dams are present in the upper reaches of the Lovu River. The Shongweni Dam on the Mlazi River has silted up over the years and is now only used for recreational and educational purposes.

The catchment has surplus water available, even taking ecological Reserve requirements into account. Poverty eradication initiatives should be considered as the first option for utilising this surplus.

The water quality in the catchment is poor, especially the Mlazi River. However, the point sources of pollution problems are known and the regional DWAF water quality personnel are dealing with these on an ongoing basis. A longer term pro-active strategy is however required to solve the water quality problems of this catchment.

The Mkomazi Key Area

The two largest water users in the catchment are industry, with SAPPI-SAICCOR's large water requirement of 44 million m^3/annum at the mouth of the Mkomazi River, and the irrigation sector. There is an estimated 81 km^2 under irrigation in the catchment with an equivalent 1:50 year requirement of about 43 million m^3/annum. Forestry is also a significant user of water with 446 km^2 under afforestation which reduces the available yield by an estimated 10 million m^3/annum. There is also an estimated 69 km^2 under dryland sugar cane but this has a very limited impact on the available resources.

Despite the large natural runoff of the Mkomazi catchment (1 067 million m^3/annum), the catchment is stressed and there is no water available for new water allocations, unless accompanied by the provision of new storage. The stressed nature of this catchment is due to the lack of storage and water requirements exceeding the natural low flow of the river. This has serious implications for the ecological Reserve which cannot be met under these circumstances, although this will probably only manifest itself during droughts.

The water quality of the catchment is generally good, especially in the upper reaches of the catchment.

The catchment is unregulated and development of major water resources infrastructure is reserved for the transfer of water to the Mgeni River System. The proposed Smithfield and Impendle Dams have been investigated for this purpose. This proposed scheme would also benefit water users in the Mkomazi catchment.

Long-term water supply solutions for the SAPPI-SAICCOR mill have been investigated before (proposed Ngwadini and Temple dams) but nothing has come to fruition. Ngwadini is a site on the main stem of the Mkomazi River while the Temple Dam is a proposed off-channel dam. SAPPI is the biggest industrial user in the catchment and relies on a temporary barrage for water supply during low flow periods, which is not favoured by DWAF. However, financial considerations may be behind the lack of progress in the construction of a permanent structure. Institutions like Mgeni Water and the Ugu District Municipality have indicated their support for the construction of a dam to supply SAPPI-SAICCOR. This could form part of a regional water supply initiative.

The South Coast Key Area

The South Coast Key Area is a largely undeveloped area with limited water requirements. Forestry and dryland sugar cane are also very limited in the area and are not significant factors from a water resources point of view. The catchment as a whole is experiencing a small deficit, which is experienced by some of the coastal resorts and the Sezela sugar mill. The water shortages of the urban sector are due to the seasonality of the tourism industry. The water-related infrastructure (including the water resources) cannot cope with the large influx of holiday-makers in December.

Umgeni Water are investigating the option of supplying the entire South Coast from the Mgeni system. While this is an option, local resources need to be investigated in more detail before a decision on this is made since there is scope for the development of the local resource. The recommendation of the South Coast Study[2] is to improve the abstraction works on the Mzimkulu and Mtamvuna. While this may be a short-term solution, it does not solve the problem of shortages that will occur if the ecological Reserve is implemented.

The water quality problems in the catchment are due to faecal contamination from over-loaded sewers, poor services in the dense informal settlement around Mzinto and excessive seasonal loads on the small sewage plants during holiday periods. Ugu District Municipality, DWAF and affected operators need to develop a strategy for dealing with this problem.

The Mtamvuna Key Area

The Mtamvuna Key Area is a largely undeveloped catchment. The only significant water requirement is that of the coastal towns which are mostly supplied through transfers from the Mzimkulu River. There are large areas of dryland sugar cane in the catchment (254 km^2) but the reduction in runoff due to this has little impact on the available yield because of its location along the coast. Irrigation in the catchment is insignificant.

The catchment has surplus water and presents an opportunity for poverty eradication.

The catchment area straddles the Eastern Cape and KwaZulu-Natal Provinces and management of the catchment is problematic due to the split responsibilities. The KwaZulu-Natal regional office is the *de facto* manager of the catchment.

The Mzimkulu Key Area

This Key Area is characterised by relatively large rural use and extensive afforestation (584 km^2), which has a significant impact on the low flow in the catchment. Further afforestation is constrained by the requirements of the ecological Reserve.

There are plans to develop forestry on communal land in the Transkei part of the Mzimkulu catchment. Based on the current estimate of the ecological Reserve, this will not be possible. A more comprehensive assessment of the ecological requirements is therefore required in this catchment before additional forestry can be considered.

The broad strategy for this catchment is a 'hands-off' management style. There are no major problems in the catchment and no pressing need for change or development. A long-term strategy for this catchment needs to be developed.

4. RECONCILIATION OF WATER REQUIREMENTS AND AVAILABLE WATER RESOURCES

A reconciliation of the water requirements and available water resources in the Mvoti to Mzimkulu WMA are shown in **Table 1.** This differs in many respects from the reconciliation given in the NWRS.

Based on the detailed analysis given in Chapter 4, the following major differences to the NWRS strategy are noted and motivated:-

- Industrial requirements of the Mvoti catchment are a lot higher than given in the NWRS and the available water resource less. This ISP therefore concludes that the Mvoti catchment is therefore even more stressed than indicated in the NWRS.
- The urban water requirements of the Mgeni system, as determined by Umgeni Water, are considerably less than indicated in the NWRS, while the water resources, as determined through detailed systems analyses[16] are significantly higher. In addition, new developments such as the raising of Midmar Dam and construction of the Mearns Weir have increased the yield of the system. The result is that in the year 2003 the Mgeni sub-area was approximately in balance and there is a large deficit as indicated by the NWRS.

Table 1: Reconciliation of allocations and available water for the year 2003 (million m³/a)

Key Area/ Sub-area	Available water			Water requirements			Balance	NWRS (year 2000)
	Local yield	Transfers In	Total	Local requirements	Transfers out	Total		
Mvoti	32	1	33	89	0	89	(56)	
Mdloti	36	0	36	31	1	32	4	
Mvoti Sub-area	68	1	69	120	1	121	(52)	(32)
Mgeni	393	38	431	431	0	431	0	
Mlazi & Lovu	49	0	49	43	0	43	6	
Mgeni Sub-area	442	38	480	474	0	474	6	(90)
Mkomazi	31	0	31	103	2	105	(74)	(68)
Mzimkulu	37	0	37	40	10	50	(13)	(34)
South Coast	12	2	14	18	0	18	(4)	
Mtamvuna	16	10	26	21	0	21	5	
Coastal Sub-area	28	12	40	39	0	39	1	(16)
Total	**606**	**38**	**644**	**776**	**0**	**776**	**(132)**	**(240)**

Note: The shaded rows in the table refer to the NWRS Sub-areas while the un-shaded rows refer to the Key Areas used in this ISP. The Key Areas are either equivalent to or a sub-division of the Sub-areas.

5. WATER RESOURCES MANAGEMENT ISSUES AND STRATEGIES

The following are the most pressing issues which have been identified through this ISP study, as well as proposed broad strategies to deal with these issues:

The Mvoti Key Area is highly stressed with water requirements far in excess of the available resource. As a result, no new water allocations are possible. Various options are currently being considered to augment the water supply to urban and industrial users in the Mvoti Key Area. These include increased transfers from the Hazelmere Dam as a short-term solution while the construction of a new dam (whether on the main stem of the Mvoti or off-channel storage) is considered to be a feasible long-term solution.

The Mdloti Key Area currently has a small surplus but with the rapid growth in water requirements of the North Coast region, water requirements are expected to exceed the available resources in the not-to-distant future. To meet these growing requirements, the intention is to raise the Hazelmere Dam and a feasibility study into this raising has already been completed.

Based on the latest simulations using the Water Resources Planning Model (WRPM) the Mgeni Key Area is approximately in balance but augmentation of the system is required by 2007/2008. These simulations are based on a 'no-growth' scenario which will require continued savings through WC&DM and the situation is therefore somewhat precarious. It is recommended that the construction of the Spring Grove Dam processed as soon as possible to limit the risk of water restrictions in the near future.

There is a small surplus available in the Mlazi and Lovu Key Area which could be allocated for poverty eradication. There are serious water quality problems in this catchment which need to be addressed urgently.

The Mkomazi Key Area is experiencing serious deficits due to the high demands placed on the undeveloped resource. The shortages are mostly experienced by SAPPI/SAICCOR at the mouth of the Mkomazi River and they overcome these shortages by constructing temporary weirs on the Mkomazi River, which is not an environmentally sustainable solution. A more permanent solution, including the construction of an off-channel dam have been investigated but have not been implemented due to a lack of finance.

The South Coast Key Area is experiencing small deficits. There are as yet no definite plans to resolve these but Umgeni Water favour supplying the area from the Mgeni System while DWAF are of the opinion that local resources should rather be developed. A WC&DM study has already been undertaken to reduce the water consumption in the Key Area.

Despite the fact that the Mzimkulu River is one of the larger undeveloped rivers in South Africa, it is experiencing a small deficit. This is manifested in under-supply to the ecological Reserve. This will need to be addressed when the Reserve is implemented, but there is no urgency for this.

There is a small surplus in the Mtamvuna Key Area which could be used for poverty alleviation.

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PART B2

General strategies applicable to the whole Mvoti to Mzimkulu WMA

GS1: Water Quality Management
GS2: Water Conservation and Demand Management
GS3: Groundwater
GS4: Monitoring and information
GS5: Poverty Eradication and co-operative governance
GS6: Alien vegetation
GS7: Implementation

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LIST OF ABBREVIATIONS

CEIMP	Consolidated Environmental Implementation Management Plan
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
DWAF	Department of Water Affairs and Forestry
ECA	Environmental Conservation Act 73 of 1989
IDP	Integrated Development Plan
IFR	Instream Flow Requirement
ISP	Internal Strategic Perspective
IWRM	Integrated Water Resource Management
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
masl	meters above mean sea level
MSAT	Mgeni System Allocation Tool
NEMA	National Environmental Management Act 107 of 1998
NWA	National Water Act 36 of 1998
NWRS	National Water Resource Strategy
PLC	Provincial Liaison Committee
RDM	Resource Directed Measures
RO	Regional Office
RQO	Resource Quality Objectives
SFRA	Stream Flow Reduction Activity
WARMS	Water use Authorisation and Registration Management System
WMA	Water Management Area
WRSA	Water Resources Situation Assessment
WSDP	Water Services Development Plan
WSP	Water Sector Plan
WUA	Water User Association

PART A

1 BACKGROUND TO THE MVOTI TO MZIMKULU INTERNAL STRATEGIC PERSPECTIVE

1.1 INTRODUCTION

The locality of the Mvoti to Mzimkulu WMA is shown in **Figure 1.1**.

Figure 1.1 Location of the Mvoti to Mzimkulu WMA

1.2 WATER LEGISLATION AND MANAGEMENT

Water is one of the most fundamental and indispensable of all natural resources. It is fundamental to life and the quality of life, to the environment, food production, hygiene, industry, and power generation. The availability of affordable water can be a limiting factor for economic growth and social development, especially in South Africa where water is a relatively scarce resource that is distributed unevenly, both geographically and through time, as well as socio-politically.

Prosperity for South Africa depends upon sound management and utilisation of our many natural and other resources, with water playing a pivotal role. South

Africa needs to manage its water resources optimally in order to further the aims and aspirations of its people. Current government objectives for managing water resources in South Africa are set out in the National Water Resources Strategy (NWRS) as follows:

To achieve equitable access to water, that is, equity of access to water services, to the use of water resources, and to the benefits from the use of water resources.

To achieve sustainable use of water, by making progressive adjustments to water use to achieve a balance between water availability and legitimate water requirements, and by implementing measures to protect water resources and the natural environment.

To achieve efficient and effective water use for optimum social and economic benefit.

The NWRS also lists important proposals to facilitate achievement of these policy objectives, such as:

- Water will be regarded as an indivisible national asset. The Government will act as the custodian of the nation's water resources, and its powers in this regard will be exercised as a public trust.
- Water required to meet basic human needs and to maintain environmental sustainability will be guaranteed as a right, whilst water use for all other purposes will be subject to a system of administrative authorisations.
- The responsibility and authority for water resource management will be progressively decentralised by the establishment of suitable regional and local institutions, with appropriate community, racial and gender representation, to enable all interested persons to participate.

1.2.1 The National Water Act (NWA)

The NWA of 1998 is the principal legal instrument relating to water resource management in South Africa. The Act is now being implemented incrementally. Other recent legislation which supports the NWA includes the Water Services Act (Act 108 of 1997) and the National Environmental Management Act (Act 107 of 1998).

1.2.2 The National Water Resource Strategy (NWRS)

The NWRS is the implementation strategy for the NWA and provides the framework within which the water resources of South Africa will be managed in the future. All authorities and institutions exercising powers or performing duties under the NWA must give effect to the NWRS. This strategy sets out policies, strategies, objectives, plans, guidelines, procedures and institutional arrangements for the protection, use, development, conservation, management and control of the country's water resources. The purpose of the NWRS is to provide the following:

- the National framework for managing water resources;
- the framework for the preparation of catchment management strategies in a nationally consistent way;
- information, in line with current legislation, regarding transparent and accountable public administration; and
- the identification of development opportunities and constraints with respect to water availability (quantity and quality).

1.2.3 Catchment Management Strategies (CMS)

The country has been divided into 19 Water Management Areas (WMAs). The delegation of water resource management from central government to catchment level will be achieved by establishing Catchment Management Agencies (CMAs) at WMA level. Each CMA will progressively develop a Catchment Management Strategy (CMS) for the protection, use, development, conservation, management and control of water resources within its WMA.

The Department's eventual aim is to hand over certain water resource management functions to CMAs. Until such time as the CMAs are established and are fully operational, the Regional Offices (ROs) of DWAF will continue managing the water resources in their areas of jurisdiction.

1.3 INTERNAL STRATEGIC PERSPECTIVES (ISPs)

1.3.1 The Objectives of the ISP Process

The objective of the ISP will be to provide a framework for DWAF's management of the water resources in each Water Management Area, until such time as the relevant Regional Office can hand over the management functions to the established CMA. This will ensure consistency when answering requests for new water licences, and informing existing water users (including authorities) on how the Department will manage the water resource within the area of concern. Stakeholders must be made aware of the bigger picture as well as the management detail associated with each specific water resource management unit.

1.3.2 Approach Adopted in Developing the ISP

The ISP for the Mvoti to Mzimkulu WMA was developed in five stages as follows:

- Determining the current status of water resource management and relevant water resource management issues and concerns in the Mvoti to Mzimkulu WMA. This was achieved through interviews with individual members of DWAF's RO and by collating information from the NWRS, WMA reports, Water Resource Situation Assessment (WRSA) reports and other catchment study reports. The following topics were discussed with Regional Office staff and their issues and concerns documented:

  - Current water situation
  - Resource protection

- Water uses
- Water reconciliation
- Water infrastructure
- Monitoring and information
- Water management institutions
- Co-operative governance
- Planning responsibilities.

A starter document of the identified issues and concerns was produced as a discussion document for the first workshop arranged for the development of this ISP.

- The first workshop was held with attendees from the Regional Office, the Integrated Water Resource Planning (IWRP) Chief Directorate of the Department as well as the consulting team. The workshop focussed on the list of general issues in the WMA as well as area-specific issues. The issues were clarified and refined during the workshop. Strategies were discussed and developed to address the issues.

- The third stage involved the preparation of the document to be used for refining strategies to address the various issues and concerns, during a second workshop.

- The fourth stage was the second workshop. During this workshop the overall management of the water resources in the catchment was discussed along with the ISP management strategies and the relevant issues and concerns. The priorities and responsibilities for carrying out the strategies were identified. First workshop attendees were again involved, as were representatives of several DWAF Head Office directorates.

- The fifth stage was the finalisation of the ISP document.

As can be deduced from the above this Mvoti to Mzimkulu ISP was prepared internally within the Department, and captures the Department's perspectives. Once approved by DWAF Management, it is intended that the Regional Office will make the ISP available to Water User Associations (WUAs), Water Service Providers (WSPs), Water Service Authorities (WSAs) and other forums for discussion and comment. These comments will be considered and worked into later versions of the ISP. By adopting this procedure this ISP becomes a working document, which will be progressively updated and revised by DWAF. Public participation forms part of the CMS process, for which the ISP serves as a foundation (see Paragraph 1.5).

The ISP does not formulate all the details pertaining to every strategy but provides a suggested framework for each strategy around which the details will be developed by the responsible authority. Where relevant and readily available, certain details have been included in the strategies. The responsible authority for the further development of each strategy is indicated. This is predominantly the Regional Office, which remains responsible for involving the relevant DWAF directorates.

1.3.3 Updating of the ISP Report

The ISP strategies should not lag behind national developments, become outdated or differ from related ISPs regarding trans-boundary management. There is therefore a need to have a standard process for updating strategies, and to prevent strategies becoming outdated by ensuring adequate feedback from national developments. Furthermore, the proposal and introduction of new strategies needs to be accommodated. It is suggested that each strategy has a version-control system. The following is necessary:

- Keep abreast of changes in national legislation and policy changes or refinements by keeping a list of all relevant legislation and supporting documents relevant to the ISP;
- Ensure consistency between the ISP strategies and national strategies through a regular review-and-update procedure;
- Annually review and ensure consistency and agreement regarding trans-boundary ISP management issues by liaising with the responsible managers of other areas and updating relevant ISP strategies if necessary;
- Annually review the priorities of required management actions and align budgets accordingly;
- Monitor the implementation of the ISP (review actions, progress, implementation and stumbling blocks);
- Incorporate feedback from stakeholders;
- Rigorously apply ISP version control.

Updating and Version Control

The actual frequency of ISP revision will be determined by the number and extent of revisions to management approaches as reflected in strategy amendments. All updates to this report, particularly with respect to amendments to the Strategies, need to be passed on to and vetted by the Catchment Manager for the Mvoti to Mzimkulu WMA. Comments are to be sent to:

The Water Resources Manager
Department of Water Affairs and Forestry
KwaZulu-Natal Regional Office
P O Box 1018
DURBAN
4000

1.3.4 The Authority of Information Contained in the ISP

The NWRS is a statutory document, subject to a high level of public scrutiny and input, and signed off by the Minister. The information contained in the NWRS is the best information and knowledge available at the time. The information in Chapter 2 and Annexure D of the draft NWRS Strategy on water requirements, availability and reconciliation was updated with comments received from the public participation process in the second half of 2002. To enable the finalisation of the draft NWRS, these figures were "closed" for changes in February 2003.

Underlying the figures in Chapter 2 and Appendix D is a set of 19 reports on the "Overview of Water Resources Availability and Utilisation", one for each WMA. These reports contain more detailed information on each WMA than was summarised for the NWRS and are referred to, in short, as "WMA Reports". The WMA reports were also finalised with the February 2003 information.

Still deeper in the background lies another set of reports (one per WMA), the so-called Water Resource Situation Assessment Reports. These reports contain a wealth of information on each WMA, but the figures on requirements, availability and reconciliation have been superceded by the WMA report and the NWRS.

The ISPs for all WMAs used the information contained in the NWRS and WMA reports as the point of departure. However, an inevitable result of the ISP process has been that better information has emerged in some cases. The reason is that the level of study is more detailed and intense for the ISP. This included very close scrutiny of the numbers used in the NWRS, and in some cases a reworking of base data and some re-modelling. Where the ISPs contain yield balance data which differs from the NWRS, these discrepancies are carefully explained. Where other differences from the NWRS are necessary these are also detailed in the ISP, with accompanying explanations.

It is required that the Department work with the best possible data so that the best possible decisions can be taken. Where the ISPs have improved upon the NWRS then this is the data that should be used. The new data contained in the ISP will also be open to public scrutiny as the ISP reports will be published on the Internet and in hardcopy, and will be presented and discussed at WMA forums. Comments received will be considered and worked into subsequent versions of the ISP on a regular (yearly) basis. The NWRS will be updated to reflect the latest understanding in each new edition.

1.4 INTEGRATED WATER RESOURCE MANAGEMENT (IWRM)

It is imperative that the natural, social, economic, political and other environments and their various components are adequately considered when conducting water resources planning and management. Water as a strategic component also interacts with other components in all environments. For example, human activities such as the use of land, the disposal of waste, and air pollution can have major impacts on the quantity and quality of water which is available for human use and for proper life support to natural biota.

Taking an even broader view, water must also be managed in full understanding of its importance for social and economic development. It is important to ensure that there is conformity between the water-related plans and programmes of the CMAs, and the plans and programmes of all other role players in their management areas. The CMAs must therefore establish co-operative relationships with a wide range of stakeholders, including other water management institutions, water services institutions, provincial and local government authorities, communities, water users ranging from large industries to individual irrigators, and other interested persons.

This integrated planning and management approach is intended, through co-operative governance and public participation, to enable water managers to meet the needs of all people for water, employment, and economic growth in a manner that also allows protection and, where necessary, rehabilitation of aquatic ecosystems. Above all, Integrated Water Resource Management (IWRM) will enable water managers to use precious water resources to assist in poverty eradication and removal of inequity.

One of the big opportunities to formally integrate a large number of actions in water resource management presents itself during the so-called compulsory licensing process. Compulsory licensing is identified in the NWRS as a very important action for implementing the NWA. However, it is not a simple action of issuing licences but a complex process of closely related and interdependent activities that will in itself formalise IWRM to a great extent. The elements contained in the process of IWRM is diagrammatically depicted in **Figure 1.2**.

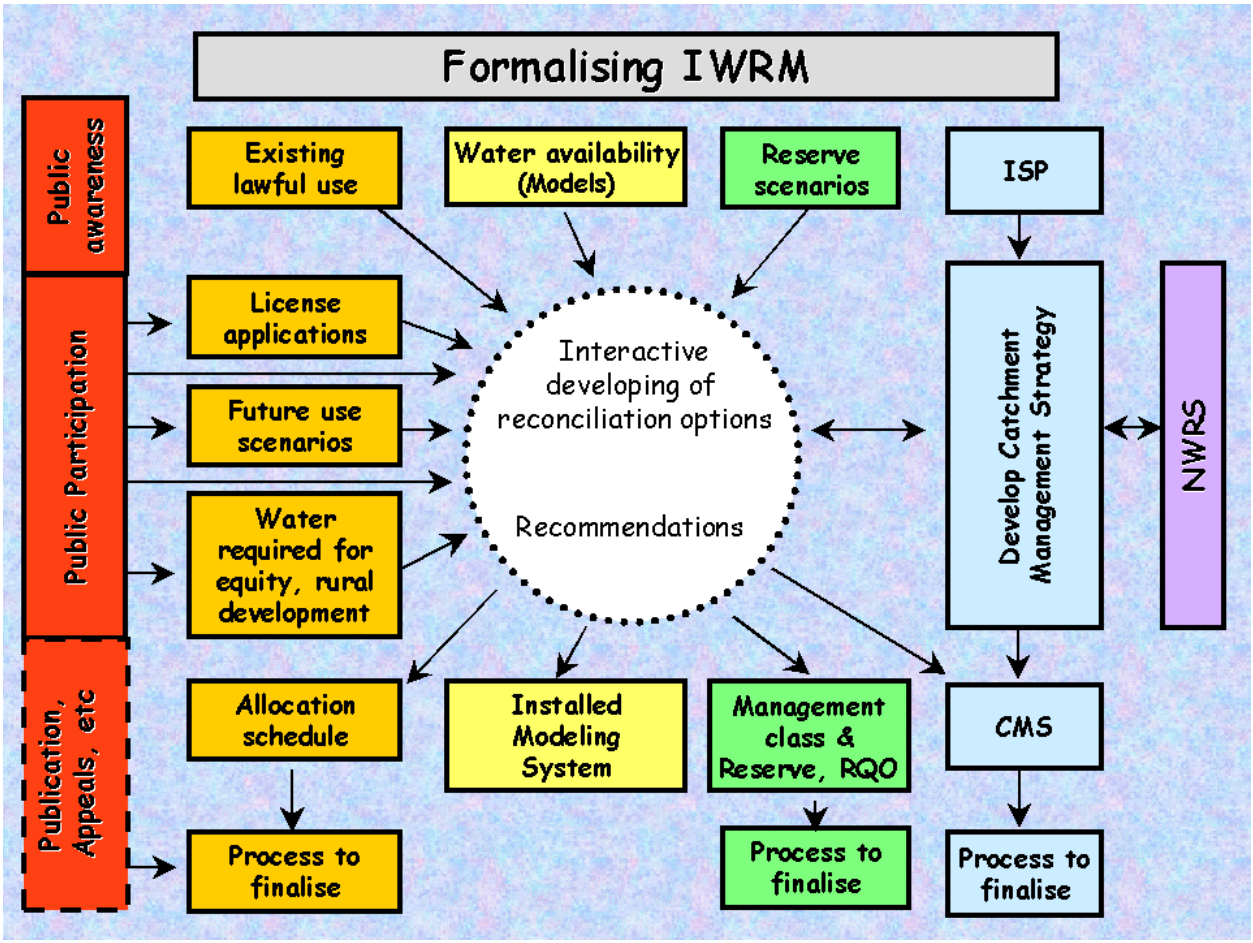

Figure 1.2: Diagram showing DWAF's Integrated Water Resource Management approach

Before an allocation schedule can be determined and the legal steps followed to finalise compulsory licensing (through the issuing of licences to all users), many other aspects must be addressed:

- Existing use and the lawfulness of that use must be verified, all users (existing and new) must apply for licences, a good understanding of future use scenarios must be developed and water required for equity purposes and rural development must be clearly understood.

- Water availability must be understood as thoroughly as possible with "best available" existing information used to model all possible reconciliation options.

- Reserve scenarios must be developed for all significant resources in the catchment, for instance, the river flow requirements for all possible classes that may be considered.

- The development of strategies for implementing the licensing (abstraction controls, for example), the Reserve and Resource Quality Objectives (i.e. incrementally over time) must go hand in hand with the rest of the processes to ensure that practical, workable solutions are found.

- The processes will then enter a very intensive, interactive phase of developing realistic reconciliation options. This would entail, for example, the selection of a specific management class to be scrutinised for its impact on the number of licences that could be issued for use, with its concomitant impacts on the social and economic structure of the catchment.

- The active participation of stakeholders in this process will then hopefully crystallise clear recommendations on an allocation schedule, management classes for the various reaches of the rivers and the resultant ecological Reserve and Resource Quality Objectives, as well as strategies for the implementation.

Although the Department will play a very strong role in guiding this process, it is extremely important to have the CMA actively involved. Preferably, at least the Board of the CMA must be in place to drive the public participation for the process.

1.5 CARING FOR THE ENVIRONMENT

DWAF is responsible for water resource development and management in terms of the NWA, and within the broader framework of other environmental legislation. The Department also strongly reflects the will to make sound decisions which ensure the development of society and the economy whilst maintaining, and where possible enhancing, ecological integrity. The concept of management of the environment has evolved from the exclusivity of protection of plants and animals to balancing the complex interaction of society, the economy, and ecology. "Environmental management is the integration of social, economic and ecological factors into planning, implementation and decision-making so as to ensure that development serves present and future generations" (NEMA).

The key legislative Acts to which DWAF is required to refer are the National Environmental Management Act (NEMA, Act 107 of 1998) and the Environment Conservation Act (ECA, Act 73 of 1989). DWAF has prepared a Consolidated Environmental Implementation and Management Plan (CEIMP) as a requirement of NEMA. This describes the Department's functions, policies, plans and programmes, and states how these comply with environmental legislation. Through the CEIMP the Department has committed itself to developing and implementing an integrated Environmental Management Framework (EMF) to ensure that its approach is aligned with the principles prescribed in NEMA and the ECA. The EMF will inform the Department at a strategic decision-making level, bring about environmental legal compliance, and help in achieving environmental sustainability through the promotion of sound environmental management practices. Integrated Environmental Management is a co-operative governance effort with DWAF as a full partner in the process.

This ISP has the responsibility of raising and maintaining the environmental consciousness of the Department's water resource planners and managers. The control over water has a very broad range of influence and impact for which strategies and planning need to account. Impacts come from many different angles.

Some of these angles of impact which are considered through this ISP are noted below:

- The direct impact of physical structures (environmental constraints to construction e.g. of weirs or dams).
- The implications of allocating and licensing water for use. Forestry and irrigation are examples of users where development based on water can mean the transformation of extensive areas of otherwise 'natural' environments.
- The allocation of water for equity. Here we can include approaches towards the application of Schedule 1 use, general authorisations, the revitalisation of irrigation schemes, etc.
- Failure to support equity, or appropriate development – noting the consequential impacts of poverty.
- Sanitation systems and the impacts on groundwater quality.
- The implementation of the Reserve.
- The ability to monitor and manage compliance, thus protecting the resource and with it the environment.

All decisions regarding water are critical to the environment. Decisions must be made on a balance of social, economic and ecological costs and benefits, considering both the immediate and the long-term, and always with an eye out for the unintended consequence. It is the intention of the ISP to provide the basis for integrated decision-making. The principles of environmental management underpin every strategy developed in this document.

There are a number of strategic areas with a particularly strong biophysical/ ecological emphasis. These include:

- the Reserve (groundwater, rivers, wetlands and estuaries)

- water quality - surface and groundwater
- the approach towards the clearing of invasive alien plants
- the management of wetlands
- land degradation. Erosion and sedimentation (land care)
- land use and especially how this is impacted by land reform and the re-allocation of water.

The roles of co-operative governance and the need for awareness raising and capacity building are key strategic elements of many strategies.

In reality all strategies and all aspects of management have a strong interaction with the biophysical environment. This ISP endeavours to capture all of these concerns in discussion and through a strategic approach which emphasises the will of the Department to manage the environment to the best benefit of the country and its people.

The approach set out above applies to all Water Management Areas and associated ISPs, and is not repeated within the Strategy Tables (Part 2 of this ISP). It reflects the way the Department views Integrated Water Resource Management and the importance of the biophysical aspects of decision-making. There may nevertheless be specific ecological and biophysical aspects of management which require specific attention and which may not be captured in the above-mentioned or other strategies. The ISP therefore still includes an Environmental Strategy which serves to make pertinent those issues of the environment which might not otherwise be covered.

1.6 THE SOCIAL ENVIRONMENT

The utilisation of water resources is aimed at the benefit of society, and at society through the economy. As noted in Section 1.5 this should not be at undue cost to ecological integrity.

Impacts on society are a core element of this ISP, and decisions are often complicated by the risk of unintended consequence. As a typical example the over-zealous implementation of the ecological Reserve may benefit the river, to the intended benefit of society, but the cost of lack of use of that water to employment and to livelihoods may lead to other strains on natural resources that undo the benefits.

The implementation of the NWA requires that society be kept at the forefront of all decision-making. This principle is now deep-seated within the Department and is integral to all strategies. Water resource allocation and use has critical social impacts, as does water quality management. But pivotal to the social component is the question of equity. What can be done and what is being done to redress past inequities? Within this, strategies have been developed to consider the provision of water to Resource Poor Farmers, the use of water under Schedule 1, Licensing and General Authorisations, etc. Whilst water supply and sanitation are not part of the brief of the ISP, the provision of water to meet these needs most certainly is. The urban poor, and the poor in rural villages, are as important in the consideration of the distribution and use of water resources as

are the rural subsistence poor, and this should not be forgotten in the urgencies of land reform and the enthusiasm to establish a substantial class of farmers from amongst the previously disadvantaged.

This ISP aims to see water benefiting society. This can be through access to water in livelihood strategies, through small-farmer development programmes, through water supply and sanitation and especially the provision of good quality drinking water, and through the maintenance and growth of income-producing, job creating, and tax paying agricultural, commercial and industrial strategies.

Consultation and public participation are cornerstones of the social component of any strategic document. These requirements are repeatedly stressed throughout the National Water Act. This ISP has been prepared as DWAF's position statement with respect to the management of water resources and, although strategies and plans have been captured without consultation with the stakeholders, it remains an open and transparent document where the understanding of the Department, its visions and its principles are made clear for all to see and to interact with. This is amplified in the Implementation Strategy (**Strategy GS 8**) of this ISP.

1.7 WATER QUALITY MANAGEMENT

Much of the emphasis in water resource management has revolved around ensuring that users have sufficient quantities of water. However, as more water gets used and re-used, as quantities get scarce and feedback loops get even tighter, it is quality that begins to take on a dominant role.

Water availability is only as good as the quality of that water. Both quantity and quality need to be considered at the correct level of detail, and this can mean that at times they should be considered with similar emphasis and with similar expenditure of resources. Too often we have failed to integrate the issues of quantity and quality – both with regard to surface water and groundwater. The concept of Available Assimilative Capacity, the ability of the water resource to absorb a level of pollution and remain 'serviceable', is as important in water resource management as is the concept of System Yield.

Quantity and quality can no longer be managed in isolation of each other. Not that this isolation has ever been total. The importance of releasing better quality water from the Inanda Dam for flushing out the Mgeni estuary and the addition of freshening releases from Vaal Barrage to bring water back to an acceptable quality has, *inter alia*, long been standard practice. The consequences of irrigation, the leaching of fertilisers, and more importantly the leaching of salts from deeper soil horizons can render both the lands themselves and the receiving rivers unsuitable for use. Diffuse agricultural 'effluent' may be less visible than direct discharges of sewage or industrial effluent, but are no less pernicious.

Direct discharges to rivers are licensed and managed on the basis of assimilative capacities of those rivers, and on Receiving Water Quality. Where these limits are exceeded, often through the cumulative impact of diffuse discharges, water becomes unavailable to some, or even all, users downstream. DWAF will licence

users to take water, and again to discharge it in recognition that there is generally a cost to the resource in terms of a reduction in quality and a reduction in its further assimilative capacity. It is for this reason, and in order to bring about additional management and a strong incentive, that the Waste Discharge Charge System is being developed. Dischargers will be obliged to pay, depending on the quantity and quality of their discharge.

Surface water quality is affected by many things including sediment and erosion, the diffuse discharges from irrigated farmland (both fertilisers and salinity through leaching), domestic and urban runoff, industrial waste, and sewage discharges. Of these, industrial waste and sewage discharges are the easiest to licence and control, but this does not mean that this is problem-free. The Department has found that the situation with regard to sewage discharges often far exceeds the standards and conditions demanded by licences. There is a problem of compliance with regard to Local Authorities and private operators responsible for waste management systems. Diffuse discharges only compound the problem by reducing the assimilative capacity until the water becomes unfit for use, very expensive to purify, and a danger to human health.

Groundwater quality requires equal attention, and more so as we recognise the importance of groundwater in supplementing our meagre resources, and providing water to remote communities. Although groundwater resources are for the most part to be found at a relatively deep level (50-100 m is quite typical) this water can easily be polluted by surface activity. The leaching of fertilisers is one such problem but of greater concern is the influx of nitrates, primarily a consequence of human habitation and sanitation. Pit latrines are on the one hand so necessary, and have the huge advantage of not requiring volumes of water, but disposal is 'on-site', and often responsible for the longer-term pollution of the underlying aquifers which feed and water the communities above.

Water quality is a very important aspect of strategy within this ISP – considered primarily within the Water Quality Strategy and also under Groundwater. Industrial wastewater discharge, diffuse agricultural discharges, wastewater treatment works, the location and management of solid waste disposal sites, the siting of new developments, informal settlements and the impacts of sanitation systems, are all elements considered with great concern in this and other ISPs. Despite this attention it may be that water quality has still not taken its rightful place in the integrated management of the water resource. But the Department is moving towards IWRM and the integration of quantity and quality issues. Managers have now been given crosscutting responsibilities that will ensure a far more integrated approach in future.

Actions recommended within the Department include:

- The need to actively workshop the integration process. Resource Management, Planning and Allocations of Groundwater and Surface Water quantity and quality.
- The review and incorporation of knowledge from recent Water Research Commission studies on both radioactivity and nitrates (groundwater quality issues).
- A review of all water quality literature reflecting situational knowledge

and understanding within this WMA (and each and every WMA).
- Ensuring that Water Quality monitoring is fully integrated into WMA water resources monitoring.

1.8 GROUNDWATER

The ISP process in all of the Water Management Areas of South Africa has highlighted the role and importance of groundwater as part of the total water resource. Although groundwater has always been important in some areas this overall vision is a significant advance on our previous understanding of the potential for groundwater use. With the surface water resources in many WMAs now fully utilised, almost the only opportunity left for further development lies in the exploitation of groundwater. More particularly it is recognised that many of the more remote towns and villages, far from surface supplies, can in fact supply or supplement existing sources through groundwater, and that this must become a priority option. So, too, many small communities and subsistence farmers can avail themselves of groundwater when it would otherwise be impossible or impractical to lay on piped supplies. This can also reduce the pressure on existing users and perhaps even circumvent the need for compulsory licensing. The Department will be developing its capacity to explore and encourage the use of groundwater.

Of obvious concern is the likelihood of an interaction between groundwater and surface water. If the interaction is strong then additional use of groundwater may simply be reducing the surface water resource already allocated to someone else. In some instances (such as in the case of dolomitic aquifers) this interaction can indeed be very strong, whilst across many areas of the country it is so weak as to be negligible. In these circumstances groundwater comprises a huge pool of available water which is only of benefit if it is utilised. Care must always be taken with the issuing of licenses to ensure that both the Groundwater Reserve and other downstream users do not end up being the losers.

The realisation in this and other ISPs is that groundwater offers a huge resource of water which can be tapped, and that this can be a very significant supplement to the national water resource.

1.9 PUBLIC RECREATION - THE USE OF DAMS AND RIVERS

The use of water for recreational purposes is one of the 11 water uses regulated in terms of the NWA (Section 21 j). The Department is developing a national policy towards 'Recreation on Dams and Rivers' and this should, in the first instance, be adhered to. Recreational use can take many forms and only occasionally has any direct impact on the water resource. Most obvious are activities such as power-boating, sailing and swimming which can have quality / pollution impacts. These activities can bring very significant economic benefits to the WMAs concerned, and where water releases can be accommodated, particularly through alignment with the needs of the ecological Reserve or other downstream users, then so much the better.

It is noted in this ISP that water resources offer a very significant recreational outlet and that recreation is an important public and social asset necessary for national health and productivity. A central philosophy is that recreational opportunity should not be unreasonably and unnecessarily denied to users, and that the implementation of policy should ensure that disadvantaged and poor people should also be able to avail themselves of opportunities.

The Department has already transferred responsibility for the management of many public waters to Local Authorities and will continue with this process. Responsibility will therefore devolve upon these Authorities, but within the broad principles as laid down by the Department.

1.10 CO-OPERATIVE GOVERNANCE – THE PLACE OF THE ISP

The ISP is DWAF's approach to the management of water resources within the WMA. This will, in the longer term, be replaced by a fully consultative Catchment Management Agency. What is important in the medium term is that the ISP has a good fit with the Provincial Growth and Development Plan, with regional and other Environmental Management Plans, with plans and expectations of the Departments of Agriculture, Land Affairs, the Environment and others. It must also be aligned with the Integrated Development Plans and Water Services Development Plans now required for each District Municipality. Water is very often a constraining feature in development and co-operative governance planning and implementation is essential in matching what is wanted with what is possible.

2 OVERVIEW OF THE MVOTI TO MZIMKULU WMA

2.1 SOURCES OF INFORMATION

The following chapter has been compiled by referring to policy documentation, legislation, regional planning, departmental guidelines and previous water resources related studies. A list of these information sources is included in the Bibliography.

2.2 LOCALITY AND PHYSICAL CHARACTERISTICS

2.2.1 Geographic subdivision

The Mvoti to Mzimkulu WMA covers the U, T40 and T50 drainage regions, as defined in the Water Resources 90 reports (Midgeley, et al, 1994). The WMA consists of two large river systems (Mzimkulu and Mkomazi), two medium-sized river systems (Mgeni and Mvoti) and several smaller river systems (e.g. Mzumbe, Mdloti, Tongaat, Fafa, Lovu). A map showing the location of the WMA is provided in **Figure 2.1.** The latter figure also denotes the political boundaries in the form of municipalities within the WMA. The larger rivers rise in the Drakensberg, the medium rivers in the Natal Midlands and the smaller rivers close to the coast. The medium-sized rivers rising in the Natal Midlands have been largely modified by human activities, mainly intensive agriculture, forestry and urban settlements.

The WMA has been subdivided into 8 Key Areas for which data and information have been accumulated and presented. The Key Areas, depicted in **Figure 2.1**, are as follows:

- Mvoti (Tertiary catchments U40 and U50);
- Mdloti (Tertiary catchment U30);
- Mgeni (Tertiary catchment U20);
- Mlazi and Lovu (Tertiary catchments U60 and U70);
- Mkomazi (Tertiary catchment U30);
- Mpambanyoni to Mzumbe or South Coast (Tertiary catchment U80);
- Mzimkulu (Tertiary catchments T51 and T52); and
- Mtamvuna (Tertiary catchment T40).

The salient characteristics of each key area are captured in **Section 4** and **Part B** (Specific catchment strategies) of this Report.

2.2.2 Topography

The WMA stretches from the Drakensberg mountains in the west at an altitude of over 3 000 m and drops to sea level in the east over a comparatively short distance of 150 km. The WMA is very rugged. It is characterised by steep slopes in the river valleys and in the Drakensberg mountains where the two big rivers, the Mkomazi and Mzimkulu rise. Very steep slopes characterise the river valleys in the inland areas for all rivers and where small streams like the Mtwalume rise. Areas of moderate slopes are found but comprise only 3% of the area of the WMA. These flatter areas are mainly subject to intensive agricultural activities.

2.2.3 Geology

The relevant geological formations occurring in the WMA are listed in **Table 2.1** and depicted in **Figure 2.2**.

Table 2.1 : Geological formations

Age	Formation or group	Lithology
Quaternary (Holocene-Pleistocene)	Alluvium Sibayi and Isipingo Formations. Unconsolidated coastal dunes, including 'Berea-type red sand'	Unconsolidated sands and clays. Unconsolidated sands and clayey sands
Intrusive	Karoo dolerite	Dolerite
Karoo (Jurassic-Permian)	Drakensberg Group Beaufort Group Ecca Group Dwyka Tillite Formation	Basalts, sandstones, shales & mudstones Sandstones, shales & mudstones Sandstones, shales & mudstones Tillite (diamictite)
Siburian-Ordovician	Natal Group	Sandstones, quartzites & shales
Late-Proterozoic	Natal Structural and Metamorphic Province ('Basement')	Granites, gneisses, amphibolites & schists

2.2.4 Soils

Soil cover throughout the area is generally shallow and is strongly parent-material related due mainly to the prevailing topographic conditions. Soils are mainly of sandy types developed on quartzose rocks, or clayey soils developed on argillaceous and basic igneous and metamorphic rocks. Deeper transported soils are present as colluvium on lower slopes, with alluvium occurring in valley bottoms and estuaries at the coast. The soils of the coastal dunes are deep. Pressure on this resource is evident from the high levels of soil erosion, arising from over-grazing, intensive cultivation, informal farming and settlements, timber plantations, and sand winning. Sediment yields of 500 to 700 tons/km^2/annum are common, which is relatively high.

2.2.5 Land use

The predominant land uses of the WMA are depicted in **Figure 2.3**. The Mvoti-Mzimkulu WMA is dominated by major urban settlements along the Durban-Pietermaritzburg axis. The Durban metropolitan area is the second largest urban area in South Africa. Several small urban settlements are located in the hinterland and support the surrounding agricultural sector (e.g. Ixopo, Greytown, Richmond, Himeville). Much of the coast both to the North and South of Durban, has been developed as small urban areas in response to the seasonal demand for holiday accommodation (e.g. Pennington, Scottburgh, Port Shepstone and Margate).

Outside of the urban areas there are large tracts of commercial and subsistence agricultural land. Timber, sugar cane, pastures and cash crops are the dominant land uses in the commercial agricultural areas, whilst degraded grasslands and scrub are typical of the subsistence agriculture areas. There has been a gradual increase of forestry in the upper Mkomazi, Mgeni and Mzimkulu areas due to a shift by commercial farmers from stock farming to timber as a result of prevalent stock theft. This has resulted in dwindling grassland areas. Patches of indigenous forests are common on the south facing slopes throughout the WMA. In the coastal area, grassland and coastal forests are being lost to make way for residential and leisure development and sugar cane farming.

The agriculture found in this WMA includes large amounts of sugar cane (both dryland and irrigated), bananas (found on the south coast), citrus (farmed near Richmond, Stanger and Darnall on the north coast), vegetables and beef and dairy pastures. The majority of irrigation utilises sprinkler irrigation systems with a growing number of centre-pivot schemes. There is also some micro irrigation along the coastline.

There is substantial industrial development in the urban areas of Durban, Stanger and Pietermaritzburg. There are no significant mining concerns or power stations situated in this WMA.

There are a number of game reserves and nature parks. The largest of these is the Drakensberg Reserve area and others are Mgeni Valley, Karkloof, Krantzkloof, Vernon Crookes, Oribi Gorge, Mtamvuna and Coleford. Two new reserves have been mooted around Pietermarizburg as a result of the settlement of the KwaXimba Land Claim and in response to the growing perception of the significant growth potential presented by tourism in KwaZulu-Natal.

A summary of the major landuses is given in **Table 2.2.**

Table 2.2: Major agricultural landuse in the Mvoti to Mzimkulu WMA

Key area	Tertiary catchments	Catchment Area (km^2)	Irrigation (km^2)	Forestry (km^2)	Dryland sugar cane (km^2)
Mvoti	U40 & U50	3 035	72	576	370
Mdloti	U30	1 310	51	4	507
Mgeni	U20	4 439	95	529	580
Mlazi & Lovu	U60 & U70	2 613	59	308	613
Mkomazi	U10	4 387	75	365	76
South Coast	U80	2 537	13	218	399
Mzimkulu	T51 & T52	6 678	60	583	179
Mtamvuna	T40	2 216	7	152	231
Total		**27 215**	**432**	**2 735**	**2955**

The distribution and location of tribal or communal lands in the WMA are summarised in **Table 2.3** and shown in **Figure 2.4.** Tribal land is fairly evenly distributed across the key areas of the WMA with the exception of the Mtamvuna River catchment, which is dominated by tribal land.

Table 2.3: Tribal areas in the Mvoti to Mzimkulu WMA

Key area	Tertiary catchments	Catchment Area	Tribal Area (km^2)	Percentage of total area which is tribal
Mvoti	U40 & U50	3 035	766	25.2
Mdloti	U30	1 310	295	22.5
Mgeni	U20	4 439	632	14.2
Mlazi & Lovu	U60 & U70	2 613	727	27.8
Mkomazi	U10	4 387	572	13.0
South Coast	U80	2 537	856	33.7
Mzimkulu	T51 & T52	6 678	1 804	27.0
Mtamvuna	T40	2 216	1 622	73.2
Total		**27 215**	**7 274**	**26.7**

2.3 THE NATURAL ENVIRONMENT

2.3.1 River ecosystems

The ecological significance of the rivers in the Mvoti to Mzimkulu WMA vary greatly across the WMA. In the north the rivers are highly developed and highly utilised to the extent that some of these northern rivers, for example the Mgeni and the Mvoti rivers, are often referred to as 'working rivers'. The implication of this is that the the socio-economic impact of improving these rivers from an ecological point would be huge. In contrast to these 'working rivers' are the near-pristine rivers in the south, most notably the Mtamvuna, the Mzimkulu and the upper reaches of the Mkomazi. The Mkomazi River is a very popular venue for white-water canoeing and there is a strong lobby calling for this river to remain undeveloped.

2.3.2 Wetlands

The estimated extent of wetlands in the entire KwaZulu-Natal is 8 100 km^2. Several initiatives are in place to increase awareness of wetland importance including the Mondi wetlands project, and KwaZulu-Natal forestry and sugar growers (Mondi, SAPPI and South African Sugar Association (SASA)) have wetland rehabilitation projects.

2.3.3 Natural vegetation

The WMA has a wide range of vegetation types ranging from coastal forest, and drier Ngongoni Veld leading to Natal Mist-belt grassland in the midlands. Inland of this, leading up to the Drakensberg, are the Sourveld grassland areas. The whole WMA and KZN province is deeply dissected by valleys where the vegetation is drier, called Valley Bushveld. Each of these veld types is a powerful

indicator of the value of the land for agricultural exploitation. The coastal forest areas have for many years been devoted to sugar production, to the extent that this is now a threatened habitat. The Mist-belt is sought after for forestry plantations, although this has also extended to the Southern Tall Grassveld that occurs inland of the Mist-belt, on land previously devoted to mixed farming, mainly with stock. Above this is the Highland Sourveld, which is marginal agricultural land. The Alpine Veld tops the Drakensberg and is the area of highest rainfall but lowest temperatures. The Valley Bushveld areas that dissect the province, generally have dry and harsh climates, and are in the most given over to subsistence and game farming. Each of these veld types has an impact on water resources that is the result of the exploitation that the area has been subjected to. The Mist-belt area, for example, suffers reduced run-off, destabilised riverbanks, siltation and invasion by alien trees (typically *Acacia Mearnsii,* or black wattle), due to intensive forestry.

2.3.4 Conservation areas

The area is poorly covered by protected areas despite the large area in the Drakensberg set aside for conservation and water provision. Coastal, Valley Bushveld and Ngongoni Veld areas in particular are not formally covered to any extent. Fortunately, several private game ranches have been established in the latter two vegetation types.

2.3.5 Invasive alien plants

Mapping of the extent of invasive alien plants has been carried out for the Upper Mgeni (Midmar, Albert Falls, and Nagle dams) and Upper Mvoti as well as the Mkomazi and Lovu catchments. This reveals that the presence of invasive alien species is a significant problem in these catchments. Refer to **Section 4** which gives the reduction in yield due to invasive alien plants. These catchments are strategic catchments in terms of water yield in the Mvoti to Mzimkulu WMA.

The extent of invasive alien plant infestation in catchments varies greatly and is also changing over time. Infestation in the eMpofane catchment (tributary to the upper Mgeni) in the KwaZulu-Natal midlands was found to be approximately 30%, consisting mainly of wattle in the riparian zones. Lower in the catchment there is a greater variety of invading species and the density of the invasives is also greater. The Mgeni catchment has been identified as the focal area of concern in view of the demand for its resources outstripping supply. It is estimated that removal of invasive alien plants in the upper Mgeni catchments (Midmar, Albert Falls, Nagle) will increase the yield at Inanda Dam by 14 million m^3/annum while, if the infestation is not curtailed, it is estimated that runoff will reduce by a further 7 million m^3/annum (Umgeni Water, 2000).

2.4 CLIMATE AND HYDROLOGY

2.4.1 Climate

Climatic conditions vary significantly across the Mvoti-Mzimkulu WMA, from the Drakensberg mountain range in the west, to the coastal areas in the east. The mean annual temperature ranges between 12^{O}C and 14^{O}C in the west to between 20^{O}C and 22^{O}C at the coast. Maximum temperatures are experienced

in the summer months from December to February and minimum temperatures in winter in June and July.

Snowfalls on the Drakensberg mountains between April and September have a significant influence on the climate of the WMA. Frost occurs over the same period in the inland areas. The average number of heavy frost days per annum range from 31 to 60 days for the inland areas to nil for the eastern coastal area.

2.4.2 Rainfall

Rainfall over the area is markedly orographically-related, as depicted in **Figure 2.4**. Average annual rainfall varies from between 1 000 mm to 1 200 mm along the coast to greater than 1 500 mm in the north-west along the Drakensberg mountains. Rain shadows occur in the interior valley basins of the major rivers where the annual rainfall can drop to below 700 mm. The peak rainfall months are December to February in the inland areas and November to March along the coast. The rainfall is seasonal with most rain falling in summer from October to March.

2.4.3 Relative humidity and evaporation

The WMA experiences a high relative humidity in summer in a similar pattern as the rainfall. There is a daily mean peak in February, ranging from 68% in the inland areas to greater than 72% for the coast and a daily mean low in July, ranging from 60% in the inland areas to greater than 68% at the coast. Potential mean annual gross evaporation (as measured by 'A' pan) ranges from between 1 600 mm and 1 800 mm in the west to between 1 400 mm and 1 600 mm in the coastal areas.

2.4.4 Surface runoff

A summary of the mean annual runoff (MAR) of the various key areas is provided in **Table 2.4**. The highest unit runoff occur in those catchments that rise in the Drakensberg (Mkomazi and Mzimkulu Rivers) whilst the lowest occur in the smaller coastal catchments.

Table 2.4: Summary of natural mean annual runoff

Key area	Tertiary catchments	MAR (million m^3/a)	Area (km^2)	Unit Runoff (mm/a)
Mvoti	U40 & U50	381	3 035	126
Mdloti	U30	214	1 310	163
Mgeni	U20	674	4 439	152
Mlazi & Lovu	U60 & U70	318	2 613	122
Mkomazi	U10	1 080	4 387	246
South Coast	U80	332	2 537	131
Mzimkulu	T51 & T52	1 373	6 678	206
Mtamvuna	T40	426	2 216	192
Total		**4 798**	**27 215**	**176**

Many areas in the WMA are susceptible to flooding due to the steep topography and weather systems such as intense thunderstorms and cut-off lows. This is exacerbated by land degradation and impervious urban areas. Most of the recent floods have resulted in loss of life, destruction of properties where development has encroached on floodplains in densely populated areas, and damage to infrastructure such as roads and bridges.

2.5 DEMOGRAPHICS

(Sourced from the WMA report[3])

The Mvoti to Mzimkulu WMA is the third most populous water management area in the country, which broadly corresponds to the proportionate contribution to the national economy. Large disparities, however, exist with respect to the socio-economic standards of living between the urban and rural areas.

Nearly 70% of the population in the WMA is concentrated in the Mgeni sub-area. Of these, more than 85% live in the Greater Durban urban complex as well as in Pietermaritzburg, to where they are attracted by the economic activity and employment opportunities. In strong contrast to the highly urbanized nature of the Mgeni sub-area, the complete opposite applies to the remainder of the sub-areas in the water management area where more than 85% of the population are classified as living in a rural environment. In total for the water management area, about 68% of the population is classified as urban and 32% as rural.

A large proportion of the rural population lives on communal land in former tribal areas, where the population densities are relatively high.

As applies to the current population distribution, the future demography of the WMA will also largely be influenced by economic opportunities and potential. Projections therefore are for continued relatively strong growth in urban population in the Mgeni Key Area, mainly as a result of strong expansion of economic activity in the Greater Durban area. Attributable to the lack of strong economic stimulants in the remainder of the WMA together with the impacts of HIV/AIDS, while the general trend towards urbanization in the country, little change in population is expected in the other Key Areas.

2.6 ECONOMICS

About 12% of the Gross Domestic Product (GDP) of South Africa originates from the Mvoti to Mzimkulu WMA, which constitutes the fourth largest contribution to the national wealth of all the WMAs following close on the Berg WMA in terms of contribution to the Gross Geographic Product (GGP) and in comparison to the national averages. The largest economic sectors (in 1997) in the WMA, in terms of the GGP, were:

- Manufacturing 28,4%
- Trade 19.1%
- Government 14,2%
- Finance 13.9%

Geographically, more than 80% of the GGP results from the Durban-Pietermaritzburg urban and industrial area.

The manufacturing sector in the WMA is well developed with a range of activities, which include metal products, machinery, basic steel and non-ferrous metals, leather products, food paper, milling and others. Most of the industrial development takes place in the Durban area, which has also become a major production and distribution centre for refined petroleum products. Some of the larger manufacturers include steel suppliers, the Toyota automotive plant, and pulp and paper as well as sugar mills. The mills, whilst reliant on the natural resource base of timber and sugar from the agricultural sector, also provide a relatively secure market for growers of these products.

The Durban-Pinetown area is the largest commercial centre in the water management area. Commercial activities are concentrated in Durban where services such as banking, insurance and other financial activities are well developed. The trade sector has also been supported by growth in small, medium and micro-size enterprises and by the informal sector.

The importance of the government and financial sectors could be attributed to the concentration of local government, corporate head offices and military services in the larger urban centres such as Durban and Pietermaritzburg.

Of the work force of 1,4 million people in the WMA in 1994, 57% were active in the formal economy and 28% were unemployed, which is essentially the same as the national average of 29%. The remaining 15% is active in the informal economy. Of those formally employed, 35% were in the government sector, 27% in manufacturing and 12% in trade.

Attributable to an existing strong, and well-integrated diversified economy together with its favourable transportation links and infrastructure, potential for future economic growth in the Mvoti to Mzimkulu WMA remains strong. The economy in the WMA is relatively more competitive than the remainder of South Africa in the transport, manufacturing, trade and construction sectors. Growth will therefore largely be attracted to the already strong economy in the Greater Durban area.

The tourism industry is also well developed and contributes to the comparative advantage of the trade sector as well as to stimulating investment along the coast.

Production in the agricultural sector can be improved through the expansion of commercial timber activities as well as by increasing the productivity from communal farming land. In general though, economic growth in the rural parts of the water management area is likely to be small and relatively insignificant compared to activities in the urban areas

2.7 INSTITUTIONS

There are five types of water-related institutions, which play a role in the Mvoti to Mzimkulu WMA. These are:

- District Municipalities;
- Local Municipalities;
- Irrigation Boards (and Water User Associations);
- Water Boards, and
- DWAF's Regional Office (in lieu of the CMA).

District Municipalities (see **Figure 2.6**) are defined as Water Services Authorities (WSA) in terms of the Water Services Act (Act 108 of 1997), and are responsible for preparing Integrated Development Plans (IDP). It is important to bear in mind though, that a Local Municipality (see below) can also become a Water Services Authority. An IDP is a principal strategic planning instrument, which guides and informs all planning, budgeting, management and decision-making in a municipality. The Water Services Act states that a Water Services Development Plan (see Local Municipalities below) must be part of the process of developing an IDP, and this is an important link between District Municipalities and the water sector. Water Services Authorities are also responsible for sanitation services and therefore play an important role in maintaining the water quality of the catchment at an acceptable level.

Local Municipalities (see **Figure 2.7**) are responsible for the preparation of a Water Services Development Plan (WSDP). The essential difference between an IDP and a WSDP is that a WSDP deals with water services while an IDP deals with all services. A WSDP must contain a **water balance component** which provides a point of reference for what is possible and what is not possible in terms of integrated development planning which impacts upon water resources. As the name indicates, this plan deals with water services, but in preparing a WSDP Local Municipalities must take cognisance of water related planning initiatives such as:

- Catchment Management Strategies
- Business plans of water boards
- Business plans of other water services providers.

This ISP forms an important step towards preparing a CMS and it is therefore essential that all IDPs and WSDPs in the Mvoti to Mzimkulu WMA are in harmony with this ISP, especially with regard to sources of raw water, to ensure co-ordinated planning. Once the CMS has been approved, it will become legally binding policy, and IDPs and WSDP will have to be in line with the CMS.

Irrigation Boards were established under the old Water Act to administer the bulk distribution of water to irrigators within a defined area. Under the National Water Act, Irrigation Boards must be transformed to form Water User Associations, which will fulfil a similar function to an irrigation board but need not necessarily be limited only to irrigation practices.

Water Boards are classified in terms of the Water Services Act as Water Services Providers and in this respect fulfil a similar role to Local Municipalities. The

difference is that a Water Board deals only with water matters, usually bulk water distribution, and not any other services. The only Water Board in the Mvoti to Mzimkulu WMA is Umgeni Water.

Although not an institution *per se,* the so-called **Provincial Liaison Committee (PLC)** also plays a role in water matters as does its sub-committees, the **Water Resources Planning sub-committee.** The purpose of the PLC is to foster communication and co-operation with Provincial Government, Water Boards and important stakeholders such as the Forestry Industry Association and Sugar Association. This committee currently serves the whole of KwaZulu-Natal and is not limited to only the Mvoti to Mzimkulu WMA. This committee meets about twice a year. The **Water Resources Planning sub-committee** co-ordinates water-related planning activities in the Province while the **Co-ordinating Committee for Agricultural Water** (formerly the Irrigation Action Committee) deals with matters related to irrigation, and the Department of Local Government's Water and Sanitation sub-committee deals with water services matters.

The **Department of Water Affairs and Forestry** is the custodian of the water resources of South Africa. Under the National Water Act, DWAF's Regional Office will fulfil the role of the Catchment Management Agency until such time as the CMA is in place and fully functional.

2.8 WATER-RELATED INFRASTRUCTURE

Several major dams have been constructed in the Mvoti to Mzimkulu WMA. The yield figures for the dams on the Mgeni River are based on the latest yield estimates carried out by Umgeni Water and incorporate the latest demand figures and infrastructure developments.

Water-related schemes which transfer water into the WMA are also described below. There are no transfer out of the WMA.

2.8.1 Transfer Schemes

The Mearns transfer scheme was constructed in 1983 to augment the yield of the Midmar Dam and hence the yield of the Mgeni River System. This scheme transfers water from the Mooi River to the upper reaches of the Mgeni River at a maximum rate 3,2 m^3/s. However, since this was abstracted from run-of river, the amount that could be transferred on average was only 50 million m^3/a. The impact of this transfer on the 1:50 year yield of the Midmar Dam was 25 million m^3/a[16]. Recently the Mearns Weir has been constructed at the abstraction site on the Mooi River to provide some balancing storage and this results in an increase in transfers. The Midmar Dam has also been raised and the impact of the upgraded transfer scheme on the 1:50 yield of the Midmar Dam is estimated at 38 million m^3/a.

2.8.2 Midmar Dam (Mgeni)

Midmar Dam, situated in the upper reaches of the Mgeni River has a net storage capacity of 235 million m^3, following its recent raising in 2003. The dam was built in 1963 to supply water to Pietermaritzburg, but now forms part of the larger

Mgeni water supply system and hence supplements supplies to Durban. The 1:50 year yield of the raised dam is 132 million m^3/a, including the contribution of the transfers from the Mooi River. The natural MAR into the dam is 202 million m^3/a.

2.8.3 Albert Falls Dam (Mgeni)

Albert Falls Dam, with a storage capacity of 290 million m^3 (1995 survey) was completed in 1976 with the purpose of supplementing the water supply to Durban as well as for irrigation. This dam is situated downstream of the Midmar Dam on the Mgeni River.

The incremental natural MAR into the Albert Falls Dam is 131 million m^3/a.

2.8.4 Nagle Dam (Mgeni)

Nagle Dam was constructed in 1950 to supply water to Durban. It is located in the lower reaches of the Mgeni River and at the time of its construction commanded much of the runoff of the Mgeni River catchment, with a cumulative natural MAR into the dam of 538 million m^3/a[22]. Due to upstream developments (Midmar and Albert Falls dams) and water use in Pietermaritzburg, the present day runoff into Nagle Dam is considerably less than this. The dam has two abstraction off-takes which supply Durban Heights Waterworks in Reservoir Hills, Durban. The dam has a flood diversion canal used to divert silt laden water during flood events. This has helped maintain the original storage capacity of the dam.

2.8.5 Inanda Dam (Mgeni)

Inanda Dam has a storage capacity of 252 million m^3 (1995 survey) and is located downstream of Nagle Dam on the lower reaches of the Mgeni River. The dam was completed in 1989 to augment the water supply to Durban from the Mgeni System, which at this point in time included the Midmar, Albert Falls and Nagle dams. It is necessary to pump the water from the Inanda Dam to Durban, with the result that Durban Metro abstract water from Nagle Dam under gravity first and supplement this from the Inanda Dam.

The incremental MAR into the dam is 61 million m^3/a while the cumulative MAR is 599 million m^3/annum (see **Table 2.6**).

The 1:100 year yield of the entire Mgeni System, including transfers in from the Mooi River, is estimated at 345 million m^3/a[16].

2.8.6 Summary of dams in the Mgeni River System

Table 2.5 summarises the hydrology of the Mgeni River system as it relates to the major dams in the system.

Table 2.5: Hydrology and storage of the Mgeni River system

Dam	Incremental Natural MAR	Cumulative Natural MAR	Storage	Cumulative storage	Storage/MAR (cumulative)
	(million m^3/a)		(million m^3)		
Midmar	202	202	235	235	1.16
Albert Falls	131	333	290	525	1.58
Nagle	205	538	25	550	1.02
Inanda	61	599	252	802	1.34

2.8.7 Hazelmere Dam (Mdloti)

The Hazelmere Dam located on the Mdloti River upstream of Canelands has a storage capacity of 17,9 million m^3 (1995 survey). This is reduced significantly from the 22.9 million m^3 in 1975 due to siltation. The dam was constructed to supply the domestic, industrial and agricultural requirements and in expectation of Durban's new international airport. Water is released from the dam for downstream irrigators and Tongaat Hullett. Purification of abstracted water is undertaken at the Hazelmere Waterworks for domestic and industrial uses.

According to the DWAF report into the feasibility of raising Hazelmere Dam[5], the 1:100 yield of the dam is 24 million m^3/a.

2.8.8 Other small dams

Several small dams have been constructed in the WMA for domestic and industrial purposes. These include the following:

- Lake Merthley in the Mvoti Catchment
- Dudley Pringle and Syphon in the Tongaat catchment,
- Nungwana Dam in the Lovu catchment
- Umzinto and EJ Smith dams in the Mzinto and Mzimayi catchments.

See also Annexure C for a comprehensive list of dams in the WMA.

2.8.9 Potential for new dams

With the exception of the Mgeni River catchment, which is fully developed from a water resources point of view, there is potential for new dams throughout the Mvoti to Mzimkulu WMA. Some of the dams which have already been investigated are the Isithundu Dam on the Mvoti River, and the Smithfield and Impendle Dams on the Mkomazi River. Although the Mtamvuma and Mzimkulu River catchments have not recently been investigated for possible dam sites, the water resources of these catchments is underdeveloped and in this respect these catchments offer potential for development.

3 GROUNDWATER

3.1 INTRODUCTION

The purpose of this chapter is to give an overview of the groundwater situation, both the current estimated use and the potential use.

The use of groundwater, and more particularly the potential for additional use, offering the possibility of allocation, even in otherwise stressed areas, has not been given enough attention in the past and is therefore highlighted in this separate chapter.

The reconciliation of water requirements with the available resource presented in Chapter 5 includes groundwater use but not groundwater potential. Groundwater potential figures quoted in this chapter are derived from the WRSA study.

3.2 GROUNDWATER OVERVIEW

Groundwater aquifer types present in the region are almost entirely of the 'hard rock' secondary porosity, 'weathered and fractured', and 'fractured' classes. 'Inter-granular' primary porosity class aquifers are present to a very limited extent in riverbeds in close proximity to the coast. In the 'fractured' class, zones of preferential groundwater presence include faults, major joints, bedding planes, and the contacts of intrusive Karoo dolerite sheets and dykes with the host rock.

The distribution of the various hydro-geological aquifers in each of the 90 quaternary catchments in the WMA is shown in **Figure 3.1**. In this figure, seven hydrogeological aquifer units reflecting the most extensively occurring geological groups and formations in each of the quaternary catchments are indicated. The major hydrogeological aquifer units occurring in the region are also indicated in **Table 3.1**.

By far the most common method of groundwater abstraction in the region is the normal 'hard rock' borehole of 165 mm diameter, with its uppermost portion (10-15 m) cased, and of depth 60 to 120 m. A few screen wells are present in the inter-granular aquifer class in deep (25 m) riverbed sands in the coastal portion of the region. Numerous natural low-flow springs and seepages of groundwater are utilised as water supply sources in the rural portions of the region.

3.3 GROUNDWATER YIELDS

Median yields of boreholes in the various geological formations in the WMA are given in **Table 3.2**. It is noted that by far the best yields are obtained from alluvial sands, but in the case of 'hard rock' aquifers, the best yields are obtained on intrusive dolerite contacts in the Beaufort and Ecca Group shales and sandstones. Otherwise the best yields are obtained from the Natal Group sandstones and the least from the Dwyka Tillite Formation. Very high yields of the order of 10 l/s (36 m³/hr) and more can be obtained in favourable locations. The

median yield of boreholes in the various 'hard rock' secondary porosity aquifers in the region is generally in the low class of borehole yield (0.1 – 0.5 l/sec).

Table 3.1 : Hydrogeological aquifer units in quaternary catchments.

Hydrogeological aquifer units	Quaternary catchments in which units occur
1. 'Basement' granite-gneiss	U20L, U40G, U40H, U80A, U80C, U80D, U80F, U80H, U80K
2. Natal sandstone and 'Basement' granite-gneiss	U10M, U20G, U20K, U30A, U30C, U40D, U40E, U40F, U40J, U60F, U70D, U80E, U80G, U80J, T40F, T40G, T52L
3. Natal sandstone	U60C
4. Natal sandstone and Dwyka tillite	U20M, U30B, U30D, U30E, U50A, U60B, U60D, U60E, U70B, U70C, U70E, U70F, T40E, T52M
5. Dwyka tillite and 'Basement' granite-gneiss	U80B, U80L
6. Dwyka tillite and Ecca shales with intrusive Karoo dolerite	U10K, U10L, U20J, T40D, T52D, T52J, T52K
7. Beaufort and Ecca shales and sandstones with intrusive Karoo dolerite	U10A, U10B, U10C, U10D, U10E, U10F, U10G, U10H, U10J, U20A, U20B, U20C, U20D, U20E, U20F, U20H, U40A, U40B, U40C, U60A, U70A T40A, T40B, T40C, T51A, T51B, T51C, T51D, T51E, T51F, T51G, T51H, T51J, T52A, T52B, T52C, T52E, T52F, T52G, T52H

Table 3.2 : Borehole yields of geological formations.

Geological formation/group	Lithology	Median yield	
		l/s	m^3/hr
Alluvium	Sands	25	90
Karoo dolerite	Dolerite	0.65	2.3
Beaufort, Ecca Group	Shales, sandstones	0.50	1.8
Dwyka Tillite Formation	Tillite	0.15	0.5
Natal Group	Sandstone, shales	0.35	1.3
'Basement'	Granites, gneisses etc.	0.20	0.7

The incidence of 'dry' boreholes obtained on drilling varies from about 40% in the case of the Dwyka Tillite to about 15% in the case of dolerite contacts and the Natal Group sandstone. This could be improved upon through more scientific siting of boreholes. The median depth to the water table in boreholes in the region is 21m.

3.4 GROUNDWATER QUALITY

Median values of electrical conductivity (EC), or salinity, of the groundwater in the various geological formations in the area are given in **Table 3.3**. In terms of

salinity, the groundwater quality in the WMA is generally very good. Salinity of groundwater in the same geological formation is somewhat higher in the coastal region than is the case inland. Water quality also tends to be more saline in the drier interior basins of the major rivers. Saline water intrusion from the sea into the coastal riverbed sands has not become a problem due to the very low level of exploitation of this type of aquifer.

Table 3.3 : Groundwater conductivity (salinity) in geological formations.

Geological formation/group	Lithology	Median conductivity (mS/m)(1)
Alluvium	Sands	76
Karoo dolerite	Dolerite	20
Beaufort, Ecca Group	Shales, sandstones	21
Dwyka Tillite Formation	Tillite	56
Natal Group	Sandstones, shales	27
'Basement'	Granites, gneisses, etc.	29

Note 1 : SABS 241/1999 standards - Ideal limit 70 mS/m, acceptable limit 50 mS/m and maximum limit 370 mS/m.

Some groundwater constituents can exceed specification limits, but such problems are very localised. This is particularly so in the case of groundwater derived from carbonaceous shales of the Ecca and Beaufort Groups, and some coastal alluvial riverbed sands in respect of iron and manganese content. Groundwaters in 'Basement' granitic rocks occasionally have elevated fluoride content.

The pollution of groundwater sources in the region is uncommon and, in respect of nitrates and E.coli, are related to very local sources where no sanitary seal has been provided to individual rural water supply boreholes that are equipped with hand-pumps. In summary, the quality of the groundwater in the region is generally very good and it is invariably suitable for human and animal consumption, as well as being suitable for agricultural and industrial purposes.

3.5 GROUNDWATER RECHARGE

The mean annual groundwater recharge in the region has been estimated as a percentage of mean annual precipitation (MAP) for the various 'hard rock' geological formations. These estimates, summarised in **Table 3.4**, were based on the analysis of the baseflows over a 70 year period for each quaternary catchment. The mean annual groundwater recharge in the WMA is estimated to be 1 150 million m^3/a (400 m^3/ha^2 or 40 000 m^3/km^2).

These recharge rates are considered relatively low and mean that, on average, a square kilometre in the area can only sustain 2 boreholes each pumping at a rate of 5 m^3/hr for 12 hours per day, on a fully sustainable recharge basis. But this is on average, with variations in terms of locally prevailing aquifer lithologies and borehole yield rates.

Table 3.4: Estimated groundwater recharge.

Geological formation/group	Recharge as % of MAP
Alluvium	6
Karoo dolerite	6
Beaufort, Ecca Group	4
Dwyka Tillite Formation	3
Natal Group	7
'Basement'	3

No specific information is available on the groundwater-surface water inter-action. As a general guideline though, the interaction will be low where boreholes are situated on low-porosity rock and high in high-porosity primary aquifers. Since most of the WMA is underlain by low-porosity rock formations, the groundwater-surface-water interaction is generally low in the Mvoti to Mzimkulu WMA. However, boreholes situated near rivers will almost always abstract directly from baseflow and in these cases there will be a very strong interaction between groundwater abstraction and surface water flow. As a result of this there is probably some double accounting in the estimates of groundwater availability which can only be resolved through detailed groundwater investigations.

3.6 GROUNDWATER USAGE

The NRWS gives groundwater usage in the Mvoti to Mzimkulu WMA at 6 million m^3/a, which is in the same order as the groundwater use of 9,3 million m^3/a given in the Water Allocation and Registration Management System (WARMS) database, as determined during the recent registration process. Bearing in mind that some of the rural Schedule1 use is probably sourced from groundwater and need not be registered, the actual use of groundwater is probably higher than that indicated by the registered water use. Nevertheless, groundwater use is clearly less than 1% of the mean annual aquifer recharge and there is therefore huge potential for greater utilisation of this resource.

Some examples of existing types of groundwater usage in the area include :

- Urban residential (wholly or in part) :
  - Nkwazi Beach;
  - Blythedale Beach;
  - Greytown; and
  - Mtwalume-Mzumbi

- Rural residential reticulated water supply :
  - Maqumbi;
  - Matimatolo;
  - Mfume;
  - Braemar;
  - Jolivet (Springs); and
  - Bombo.

- Rural domestic and stock watering individual communal borehole supply:

Numerous throughout Traditional Areas

- Industry (wholly or in part) :
  - Engen Oil Refinery;
  - Sezela Sugar Mill;
  - Gledhow Sugar Mill;
  - Noodsberg Sugar Mill; and
  - SAPPI Fine Paper Mill.

- Agricultural usage :
  - Vegetable production in Richmond area.

From the foregoing it is apparent that, at present, groundwater usage in general represents only a small fraction of the available resource on a fully sustainable annual groundwater recharge basis. The exploitable groundwater (i.e. groundwater potential) distribution in the Mvoti to Mzimkulu WMA is depicted in the groundwater potential map **Figure 3.2**. This mapping has been based on the borehole yields and theoretical number of boreholes per quaternary catchment.

3.7 GROUNDWATER USAGE MANAGEMENT CONSIDERATIONS

The main constraints on groundwater usage on any major scale in the region concerned include:

- Generally low yield of boreholes, but this can be improved by scientific siting of new boreholes;
- Spatial problems of not locating boreholes in too close proximity to each other, such that mutual interference and reduction in yield occurs;
- Lack of maintenance and the provision of operational costs of boreholes, in rural areas, unless operated and costs recouped and borne in part at least by an appropriate Authority;
- Frequent finite life and yield decline with time of boreholes due to collapse, iron deposition, etc., which calls into question the likely success of attempts at regulation by DWAF of borehole installation and groundwater abstraction due to difficulties in administration that will be associated therewith;
- The existing DWAF National Groundwater Database is of limited use due to its broad scale of reference and its incompleteness, and
- Possible impacts on downstream surface water users – this being a function of the groundwater/surface water interaction.

3.8 GROUNDWATER MANAGEMENT ISSUES

3.8.1 Historical situation

Historically, urban water supply was provided by the major municipalities such as Durban and Pietermaritzburg and Regional Water Supply Corporations such as Pinetown and Lower South Coast. Rural water supply boreholes were provided initially by DWAF for many years. This responsibility was later taken over by the Department of Agriculture and Forestry of the KwaZulu Government Service. Some boreholes were also installed as Government Drought Relief measures.

With the demise of the KwaZulu Government Service in 1994, the Umgeni Water Board, which had become the bulk water supplier to the major municipalities and Regional Water Supply Corporations, started to become involved in reticulated water supply in rural areas, some of which were borehole sourced. In recent years, Umgeni Water has been distancing itself from this function. Rural areas in the WMA have recently all become part of District Municipalities whose responsibility it has become to provide water in such areas.

3.8.2 Current situation

The major water supply issue is undoubtedly the provision of water to rural areas by the relevant Municipalities in terms of the National Government's water supply programme. Water supply to urban areas is already adequately catered for. Given the spatial conditions and population densities prevailing in the rural areas, as well as the generally steep topographic conditions prevailing therein, water supply from groundwater boreholes in these areas is the most practical and economic method of water supply.

As indicated above, the presently largely unused groundwater resource is available over the WMA region as a whole, and will be adequate to supply rural needs on a fully sustainable basis, given the relatively low volumes of water that will be required, within the constraint of the generally low yield of 'hard rock' boreholes in the region.

3.8.3 Future situation

Previous attempts at groundwater supply from boreholes in rural areas have virtually all floundered on the lack of provision of adequate maintenance. In the future the responsibility for this and other operational costs will have to be assumed by the Municipality responsible for installing the boreholes. The Municipalities will have to be prepared to fund the capital cost of borehole installation and other related costs, and cross-subsidise the operational and maintenance costs of borehole water supply in rural areas given the lack of financial resources by the population of the rural areas to be able to contribute to such costs. Management of boreholes is essential to sustainable use and longevity and for this groundwater levels must be carefully and continuously monitored. At present there is absolutely no monitoring anywhere in the region. It is felt that if local Municipalities take responsibility for the installation and management of boreholes (which include raising the funds to do this) it will be in their best interest to ensure that a monitoring programme is put in place.

In some rural districts where water requirements are limited, it may be possible to provide safe water supply through adequate protection of the larger-yielding natural springs sometimes present. These springs will probably already be in use as a water supply by the local population. As part of a future programme for rural water supply from groundwater resources, it will be essential for the Municipalities to conduct an appropriate Public Awareness and Capacity Building Campaign among the affected local structures and population, especially in schools. In this regard it should be emphasised that the boreholes and any related reticulation works are effectively owned by the community

involved, and that the Municipalities are only the Administering Agents for the provision of the water.

The following conclusions can be made from the above situation assessment:

- Present usage for various purposes of groundwater in the Mvoti to Mzimkulu WMA comprises only a small fraction (1%) of the fully sustainable annual recharge source of this area. Further use could safely be made of this presently very under-utilised resource.
- Undoubtedly the main water management consideration in the Mvoti to Mzimkulu WMA is the provision of water to the rural areas, for which function the Municipalities have recently become responsible.
- The available fully sustainable groundwater resource is, in most instances, the most practical and economic method of providing the necessary water in such areas. Apart from capital cost, adequate provision must be made for operational and maintenance costs, as well as local community involvement. Most previous attempts at using the groundwater resource in the region have largely failed due to the lack of provision for these needs.
- Monitoring is essential to sustainable use.
- Groundwater/surface water interaction is generally weak in this WMA.
- Groundwater yields are, for the most part, low but well distributed across the WMA. There is opportunity for limited but very extensive use of groundwater without significantly impacting on other current water users. This use (if small) could be made on the basis of Schedule 1 for subsistence agriculture and gardening, to meet Basic Human Needs, or could be licensed in the event of a commercial operation.

4 STRATEGIC WATER RESOURCE/WATER QUALITY PERSPECTIVE OF THE WMA

4.1 INTRODUCTION

This chapter documents the details of the water resources, water requirements and water quality of the catchment as obtained through this ISP process. The water balances are similar to those given in the NWRS, but where changes are suggested, the improved information is carefully motivated and will be incorporated into future updates of the NWRS. Key issues are identified out of the water balance information and broad strategies developed to address these issues. Detailed strategies are attached in **Part B** of this report.

The estimates of water availability and requirements for the Mvoti to Mzimkulu WMA are based on the NWRS, supplemented by more recent information where available. The NWRS has grouped the catchment into five sub-areas, the Mvoti, Mgeni, Mkomazi, Mzimkulu, and the coastal catchments. However, some of the catchments thus lumped together are very different from each other and this ISP has chosen to separate and then group the WMA into eight distinct key areas. These eight key areas are shown in **Figure 2.1.**

4.2 MANAGEMENT OBJECTIVES

There are a number of generic objectives relating to the management of the water resources of the Mvoti to Mzimkulu WMA. These are:

- Effective and sustainable use and management of the water resources in the catchments of the WMA, recognising the ecological Reserve, and the value of water as an asset for economic and socio-economic benefit;
- Equitable allocation of the available water resources to encourage the development of the rural economy to contribute to poverty eradication;
- To make more efficient use of the existing available water resources by all water user sectors. This will enable the CMA to free up additional water, which can be put to beneficial use;
- Achieving water quality that is fit for its intended purpose, with the negative externalities being borne by the responsible institutions (polluter-pays principle) and maintaining aquatic ecosystem health on a sustainable basis; and
- To ensure availability of reliable data and information on all aspects of integrated water resources management and potential development in the WMA.

In many cases there are more detailed objectives relating to specific issues or problems. These are provided in the strategies attached as **Part B**.

4.3 METHODOLOGY

As mentioned in Chapter 1, the NWRS will be published in 2004, making details on the water use and availability in the whole of South Africa available to the public. The information in this ISP needs to be aligned with the NWRS, but the ISP process has also provided an opportunity to update and improve on the water balances in this document. Water resource information in the NWRS was gathered at national scale and more precise analysis and consideration at catchment level has resulted in some suggested changes. The water resource information provided in this ISP should be considered the best available, and will be used (unless further improved) in the next update of the NWRS.

The methodologies used to present the water availability, water use and yield balance in this ISP are essentially the same as in the NWRS. While these are well documented in the WMA report[3], some of the more important points are highlighted here for convenience.

Afforestation, dryland sugar cane and invasive alien plants all reduce the natural runoff from a catchment through increased rainfall interception and increased transpiration. This reduces the yield available in the catchment. However, from a legal and economic point of view, afforestation, dryland sugar cane and invasive alien plants are different and need to be treated differently from a water resources perspective.

- Afforestation is a declared streamflow reduction activity (SFRA) and hence subject to control by DWAF. The estimated impact of afforestation on available yield is therefore listed as a water use.

- Dryland sugar cane is not an SFRA although steps are being taken to declare it. Until such time, and for the purposes of this report (and the NWRS), it's impact is incorporated into estimates of water resource availability, and reflected as a reduction in yield rather than as a water use.

- Invasive alien plants are dealt with in the same way as dryland sugar cane. The difference is that DWAF are actively trying to reduce this impact through the Working for Water programme, whilst dryland sugar is a legal activity with large economic benefits. The impact of dryland sugar cane on the yield is unlikely to change much in the foreseeable future, therefore, while that of invasive alien plants represents a possible opportunity to make more utilisable water available for productive use.

Water for the ecological Reserve is water that must remain in the river and may not be abstracted. This is expressed as an estimated reduction in available yield and shown as part of the resource. The total resource available under natural conditions has been estimated, the impacts of invasive alien plants and dryland sugar cane considered in this estimate, and the utilisable resource then reduced by the requirements which the ecological Reserve has on this resource.

The categories used to define water use are the same as those used in the NWRS. Urban use in this context includes domestic and industrial use within the

urban area. Large industries which have their own source of water are listed under *mining and bulk* users. Rural use includes domestic use in small settlements and on farms, as well as stock watering.

The Water Resources Yield Model (WRYM) has been used extensively during previous studies for many of the river systems in the WMA. These WRYM files were acquired and updated with the latest water requirements and streamflow reduction data and used as the basis for determining the available water resources in these catchments. **Table 4.1** provides an outline of the previous studies for which the WRYM systems were set up within each key area. In catchments where no previous water resource analyses have been carried out, these were modelled using the Rapid Simulation Model[8].

Table 4.1 : Summary of systems analyses undertaken in previous studies.

Key areas	Study
Mvoti	WRYM System Analysis based on Mvoti River Dam Feasibility Study, Supporting Report No 3, Hydrology (DWAF, 1995). The U50A was modelled using the Rapid Simulation Model.
Mdloti	WRYM System Analysis of the Mdloti System based on Raising of Hazelmere Dam Feasibility Study, Draft Hydrology Report (DWAF, 2002). The WRYM system based on the Mgeni Sytems Analysis study (1993) was used for the Tongaat and Mhlali River catchments.
Mgeni	WRYM and WRPM System Analyses based on Mgeni River System : Mkomazi / Mgeni / Mooi River Hydrology Update (DWAF, 1999).
Mlazi and Lovu	The WRYM system analyses from the Mgeni Sytem Analysis study (1993) was used for these catchments.
Mkomazi	WRYM System Analysis based on a study to develop a Decision Support System for the Operational Planning of the Middle South Coast (Umgeni Water, 2002).
South Coast	WRYM System Analysis for U80E, F & H based on a study to develop a Decision Support System for the Operational Planning of the Middle South Coast (Mgeni Water, 2002). The WRYM was not configured for U80A, B, C, D & E, so these catchments were modelled using the Rapid Simulation Model.
Mzimkulu	Rapid Simulation Model using data from the Southern KwaZulu-Natal Water Resources Pre-feasibility Study (DWAF, 2002).
Mtamvuna	Rapid Simulation Model using data from the Southern KwaZulu-Natal Water Resources Pre-feasibility Study (DWAF, 2002).

The water resource situation (availability, requirements, water balance and reconciliation) is considered in detail for each key area in the following pages.

4.4 MVOTI KEY AREA

4.4.1 Introduction

The Mvoti Key Area consists of the two tertiary catchments of U40 (Mvoti River) and U50 (Nanoti River) (see **Figure 2.1**). The area includes the urban and peri-urban areas of Stanger, Greytown, Zinkwazi, Darnall and Groutville. The Key Area consists mostly of communal land inland (Mapamulo), commercial timber in the upper reaches of the Mvoti catchment, dryland and irrigated sugar cane along the coastal strip. A significant portion of the water allocations as well as dryland sugar cane in the Mvoti Key Area are in the hands of emerging farmers.

The main storage dam in the Mvoti catchment is Lake Merthley, which supplies Greytown. The town of Stanger in the lower reaches of the catchment relies on run-of-river yields and supply from the Mdloti catchment.

While the MAR of the Mvoti Key Area is relatively high (435 million m^3/a), the means to harness this resource through the construction of dams is limited by various factors. Small dams on the main stem of the river are not viable due to the high sediment load, while larger dams which could serve the whole region, while technically feasible, would be very expensive due to the unfavourable geology.

4.4.2 Hydrology

The main water use activities in the Key Area are irrigation (widespread especially in quaternary catchment U40J), and afforestation (quaternary catchments U40A, B and C). Invasive alien plants also have a significant impact on the resource. There is significant domestic and industrial water use in and around Stanger at the bottom of the Mvoti catchment. The most recent system analysis undertaken for the Mvoti River catchment was for the Mvoti River Dam Feasibility Study[11]. It should be noted that the Nanoti River catchment (U50) was not included in this analysis. This single quaternary catchment was therefore modelled using the rapid simulation model and the water requirements and resources added to those of the Mvoti catchment. The Water Resources Yield Model (WRYM) used for the Mvoti River study[11] formed the basis for this assessment of the water resources.

Table 4.2: Summary of the hydrology of the Mvoti Key Area.

Quaternary catchments	Area (km^2)	Mean annual runoff (million m^3/a)
U40	2 737	375
U50	298	60
Key Area Total	**3 035**	**435**

4.4.3 Water resources

There are no major dams to harvest the runoff from the Mvoti or Nanoti catchments and the available surface water resources is derived mostly from run-of-river and farm dams. The only dam of any significance is Lake Merthley

which is situated in the upper reaches of the Mvoti catchment and supplies water to Greytown.

Table 4.3 summarises the water resources of the catchment.

Table 4.3: Surface water resources of the Mvoti Key Area (at a 1:50 year assurance)

Resource category	Available/impact (million m^3/a)
Gross surface water resource	44
Subtract:	
- Ecological Reserve	10
- Invasive alien plants	4
- Dryland sugar cane	4
Net surface water resource	26
Groundwater	1
Return flows	5
Total local yield	32
Transfers in	1
Grand Total	**33**

The Mvoti catchment is linked to Umgeni Water's water supply infrastructure which allows the conjunctive use of local resources and water from Hazelmere Dam. The tendency is for users in the Mvoti catchment to utilise local resources first before utilising water from Umgeni Water, which costs more. As a result, it is difficult to put accurate figures to the amount of water transferred into the Key Area.

A comprehensive Reserve determination has not been carried out in the Mvoti Key Area. Based on a desktop analysis, the ecological requirement is estimated to be 22% of the MAR for a Class C Ecological Management Category. The impact of this on the available yield is estimated at 10 million m^3/a.

The impact of invasive alien plants and dryland sugar cane have been taken into account when determining the available water resource. The total impact on the resource is quite high but, because there is relatively little storage, actual impact on accessibility to other users remains limited. This does not mean that this use, particularly in the dry season, is not of critical importance. The reduction in runoff due to invasive alien plants is significant in the Mvoti Key Area, estimated at 21 million m^3/annum with an impact on available yield estimated at 4 million m^3/annum. The large areas of dryland sugar cane in the Key Area (341 km^2) reduce the natural runoff by an estimated 31 million m^3/a[11] and this is estimated to reduce the available yield by a further 4 million m^3/a.

There is a small transfer from the Hazelmere Dam to Stanger which is operated by Umgeni Water. This transfer is only used periodically to supplement the run-of-river abstractions from the Mvoti River. The reason for this periodic use is that Stanger prefers to utilise its own cheaper water resource before resorting to the Umgeni Water supply. There are apparently bottlenecks on the pipeline and pump stations of this transfer. If these are resolved it should be possible to transfer up to 5 Ml/day or 2 million m^3/annum if operated continuously.

4.4.4 Water requirements

The largest water user in the Mvoti Key Area is the irrigation sector. There are numerous conflicting estimates of what this requirement may be, but the NWRS estimate of 48 million m^3/annum at an equivalent 1:50 year assurance seems to be in line with other estimates and has been accepted for the purposes of this ISP.

The second largest water user in the catchment is the industrial sector. Two industries, the Gledhow sugar mill and SAPPI are situated in the lower reaches of the catchment, both with water use of just under 10 million m^3/a (WARMS). SAPPI abstract their water from run-of-river and frequently experience water supply problems. These are partially overcome by digging wells in the alluvial sands of the Mvoti River.

A summary of the present day water requirements is outlined in **Table 4.4**.

Table 4.4 : Water requirements in the Mvoti Key Area (at a 1:50 year assurance)

Water use activity	Requirement (million m^3/a)
Urban	6
Industrial	20
Rural	7
Irrigation	48
Afforestation	8
TOTAL	**89**

Sources: WMA report except for industrial use, which was sourced from WARMS

Two instream flow requirements (IFR) sites were simulated based on the desktop methodology of Hughes. The Estuarine Flow Requirement (EFR) determined in the Mvoti River Dam Feasibility Study[11] was also included in this analysis.

4.4.5 Reconciliation of water requirements and available water resources

A reconciliation of the water requirements with the available resource is given in **Table 4.5**.

Based on the above water balance given in **Table 4.5**, the Mvoti Key Area appears to be highly stressed with requirements greatly exceeding availability at a 1:50 year assurance. Some of this apparent stress is likely due to a lack of understanding of the water resources of the catchment. For example, when surface flow in the lower Mvoti River is low, the large abstractors (SAPPI, Stanger

and Gledhow) dig deep pits in the alluvial river bed and effectively abstract groundwater. This substantial groundwater resource is not reflected in **Table 4.3** because it has not been quantified. It would also be difficult to quantify in the simple terms used in this ISP, but what is clear is that through the conjunctive use of surface and groundwater, industries in the lower Mvoti catchment have managed to cope.

Table 4.5: Reconciliation of the water requirements/allocations and the water resource in the Mvoti Key Area (million m^3/a)

Available Water	Local yield	32
	Transfer In	1
	Total	33
Water requirements	Local requirements	89
	Transfers out	0
	Total	89
Balance		**(56)**

The implications of the stressed situation are as follows:-

- Irrigators are receiving water supplies at a low level of assurance. This may not be such a big problem however, since the rainfall in the area is fairly high and irrigation is probably mostly supplementary and not continuous. This could also mean those irrigation requirements have been over-estimated.

- Urban and industrial users near the mouth of the catchment run a high risk of water restrictions.

- Anecdotal evidence indicates that Greytown experiences water shortages but it appears that this is primarily due to poor operation of the water supply system.

- Implementation of the ecological Reserve will exacerbate the already stressed situation in the catchment. However, due to the limited storage in the catchment, the impact of the ecological Reserve will not be as high as in many other catchments.

A direct comparison with the NWRS is not possible because the NWRS includes the Mvoti and the Mdloti catchments in a single sub-area. Refer to **Table 4.33** and **Table 4.36** for a comparison with the NWRS.

4.4.6 Water quality

The only current significant water quality problem in the Mvoti Key Area is effluent from the sugar and paper mill situated near the mouth of the catchment. The effluents have at times seriously affected the estuary. The large-scale irrigation in the Mvoti catchment has not as yet resulted in a noticeable deterioration in

water quality. Nevertheless, a number of potential problems have been expressed by the Regional Office. These are:

- Potential for erosion in the upper catchment due to poor forestry and logging practices;
- Faecal contamination in the area of Greytown;
- Intensive commercial agriculture with the resulting potential for pollution from pesticides and nutrients; and
- Serious erosion due to steep slopes and very poor farming practices in the middle reaches of the catchment.

KwaDukuza (Stanger) has limited faecal and small industry pollution. The Potential Health Risk Index (E. coli index), derived from the national DWAF Pollution Health Risk Index, shows the catchment to have a low-moderate pollution health risk, with the lower Mvoti catchment being the most impacted and classified as eutrophic.

4.4.7 Future scenarios

The growth in water requirements in the Mvoti catchment will probably be limited to growth in domestic use due to improvement of water services to rural communities and new residential development around Stanger, mainly low cost housing. Expansion of coastal resorts in the U50 catchment is likely but the water requirements of these are small. Irrigators in the catchment are already stressed and no additional licences will be issued to this sector.

Potential for new water resources development exist on the Mvoti River. Several dam sites, both on and off-channel have been investigated. The Isithundu Dam site was deemed the most feasible option (by DWAF[11]) and yields for a possible dam at this site are given in **Table 4.6**. The viability of such a dam depends largely on being able to recover the cost of the dam through water sales. A joint scheme which entailed supplying urban/industrial users as well as irrigators was investigated in some detail but it was found that the cost of the water would be beyond the reach of commercial irrigators. Umgeni Water investigated the possibility of constructing a small off-channel dam in the U40J quaternary catchment. This would require a full feasibility study before making a decision on this scheme but it does appear to be an attractive alternative.

The alluvial aquifers of the lower Mvoti could also probably meet the growing water requirements of Stanger and the surrounding industries but this would need to be investigated in more detail.

Umgeni Water is planning to lay a large pipeline to Stanger to resolve the existing bottleneck in the supply to Stanger from Hazelmere Dam. This would make it feasible to supply Stanger fully from Hazelmere Dam, once it is raised. DWAF is however more in favour of developing the resources locally in the Mvoti catchment.

Possible future options for water supply to Greytown are shown **Annexure B**. These consist of the development of additional boreholes, catchment management activities such as the removal of invasive alien plants, timber

clearing, implementation of improved operating procedures, or the construction of another small dam.

The implementation of water conservation and demand management activities should receive attention in the area, which could result in lower water requirements. The water quality of the catchments is expected to improve in future due to these measures.

Table 4.6 : Yields for various Isithundu Dam development options

Isithundu dam size (million m^3)	Historical yield (million m^3/a)	Stochastic yields (million m^3/a)		
	Firm yield	1:50 years	1:100 years	1:200 years
51	45,4	49,0	47,0	45,1
102	56,5	67,3	63,2	59,4

4.4.8 Summary, key issues and broad strategy

Land use in the Mvoti Key Area consists mostly of communal land inland (Mapamulo), commercial timber in the upper reaches of the catchment, dryland and irrigated sugar cane along the coastal strip, and urban areas of Stanger and Greytown.

The water resources of the Mvoti catchment are poorly developed and have not kept pace with the water requirements. As a result the requirements far exceed the available resources and the catchment can be considered as stressed. Water resources development for future scenarios in the Mvoti catchment could take the form of dam development on the Mvoti River, increased supply from Hazelmere Dam or the possible development of the alluvial aquifers in the lower Mvoti River. These options need to be considered in more detail. Improved operating rules of Lake Merthley and boreholes, coupled with catchment management activities like invasive alien plants removal would delay the immediate requirement for new water resources schemes. Several small dam sites have also been investigated for augmenting Greytown's water supply.

There is no scope for further water allocation in the Mvoti catchment unless accompanied by the provision of storage or additional transfers into the catchment, both of which are feasible options. No decision has yet been made on which augmentation option to implement. A significant portion of the water allocations as well as dryland sugar cane in the Mvoti Key Area are in the hands of emerging farmers. While accurate figures on this are not available, the situation will need to be understood better before considering re-allocation for poverty eradication purposes.

Additional allocations for basic human needs or other high priority use such as industrial use, could be made available through the following measures:

- Water conservation and demand management;
- Effluent reuse at the mouth of the catchment;
- Water resources development in the Mvoti catchment;
- Trading of water rights;

- Increased transfers from the Hazelmere Dam.

The current situation with the ecological Reserve is that while it has not yet been comprehensively determined or implemented, the highly stressed nature of the catchment is a clear indication that it is not being fully met. This would be the case mostly during droughts while in wetter periods the Reserve is probably mostly met. The implementation of the ecological Reserve in the catchment will result in the aggravation of the current situation, which is already marked by periods of curtailments during low flow periods. The broad strategy for this catchment is therefore not to implement the ecological Reserve immediately, but to do this in a phased manner together with compulsory licencing to deal with the problem of over-allocation.

4.5 MDLOTI KEY AREA

4.5.1 Introduction

The Mdloti Key Area consists of the U30 tertiary catchment which includes the Mdloti, Tongaat and Mhlali rivers (see **Figure 4.1**). Most of the land is communal and used for dryland and irrigated sugar cane. The main urban areas found in this Key Area are Tongaat, Canelands, Verulam and Umhlanga. The main water use activities in the catchment are irrigation (mainly in quaternary catchment U30B, C and D), dryland sugar cane (widespread but especially in quaternary catchment U30E), domestic use, commerce and industry. The proposed Dube Trade Port consisting of La Mercy Airport and an industrial zone is located within the catchment. The water resources implications of the Port are accommodated in the eThekwini Municipality's (Durban Metro) future water requirements.

The major impoundments in the catchment are the Hazelmere Dam in U30A, and Dudley Pringle Dam in U30D. A feasibility study into raising Hazelmere Dam for future water requirements was completed in 2002 and concluded that there is merit in raising the dam.

4.5.2 Hydrology

The hydrology of the Mdloti Key Area is summarised in **Table 4.7.**

Table 4.7: Summary of the hydrology of the Mdloti Key Area.

Catchment	Quaternary catchments	Area (km^2)	Mean annual runoff (10^6m^3)
Mdloti River	U30A,B	597	100 (1)
Tongaat River	U30C,D	423	72 (2)
Mhlali River	U30E	290	47 (2)
TOTAL		**1 310**	**219**

Source: 1: DWAF, 2002
2: DWAF, 1999

The most recent systems analysis undertaken for the Mdloti River catchment was for the Raising of Hazelmere Dam Feasibility Study(5), and this was used as the basis for assessing the water resources for this ISP. However, the Tongaat and

Mhlali Rivers (U30C, D and E) were not included in the above study. The Rapid Simulation Model[8] was therefore used in these catchments to determine the available yield and the impact of water use on this yield. The hydrology used in this analysis was sourced from a recent update of the hydrology of most of the WMA[9].

4.5.3 Available water resources

There are a few dams in the Mdloti Key Area which contribute significantly to the available yield. The largest of these dams is the Hazelmere Dam situated on the Mdloti River. Based on a recent survey, the capacity of this dam is 17,9 million m^3. In a recent study into the feasibility of raising this dam[5], the 1:50 year yield of this dam was estimated at 25,5 million m^3/a, reducing to 16,2 million m^3/a when the ecological Reserve is implemented. Raising the dam as proposed in the feasibility report will increase the yield by approximately 8,5 million m^3/a.

Other smaller dams are the Dudley Pringle and Syphon dams situated in the Tongaat catchment.

A summary of the water resources in the catchment is given in **Table 4.8**.

Table 4.8: Summary of the water resources of the Mdloti Key Area (at a 1:50 year assurance)

Resource category	Available/impact (million m^3/a)
Gross surface water resource	51
Subtract:	
- Ecological Reserve	9
- Invasive alien plants	5
- Dryland sugar cane	4
Net surface water resource	33
Ground water	0
Return flows	3
Total local yield	36
Transfers in	0
Grand Total	**36**

There are significant return flows from the Mdloti and Tongaat catchments. However, it has been assumed in this ISP that return flows from the urban and industrial sectors are not readily utilisable since they occur close to the coast and are discharged to the sea. Only the return flow from irrigation has been assumed to be utilisable. Nevertheless, industrial return flows are a source which could conceivably be harnessed to increase the available resource.

4.5.4 Water requirements

A summary of the present day water requirements is outlined in **Table 4.9.**

Table 4.9 : Water requirements of the Mdloti Key Area (at a 1:50 year assurance)

Water use activity	Requirement (million m^3/a)
Urban	3
Industrial	6
Rural	3
Irrigation	19
Afforestation	0
Total	31
Transfer out	1
GRAND TOTAL	**32**

Notes:
1. Sources: WRSA report for Mdloti Key Area, WMA report for the Mvoti sub-area.
2. The transfer out of the Mdloti Key Area to the Mvoti Key Area is internal to the Mvoti sub-area. There is no net transfer out of the sub-area as defined in the NWRS.

By far the largest water use in the Mdloti Key Area is irrigation. This consist mostly of sugar cane. The irrigation requirement has reduced recently, probably as a result of the registration process. Irrigators were not paying for water from the dam but with the prospect of catchment management charges, many irrigators did not register their water use. This has resulted in a reduction in irrigation requirements of 9 million m^3/a. Other significant water use is the industrial use of the Tongaat Hulett sugar mill. The small urban requirement is that of the towns of Tongaat, Verulam, Canelands and Umhlanga.

4.5.5 Reconciliation of the water requirements and the available resource

A reconciliation of the water requirements with the available resources is given in **Table 4.10.**

Table 4.10: Reconciliation of the water requirements and the water resource in the Mdloti Key Area (million m^3/a)

Available Water	Local yield	36
	Transfer In	0
	Total	36
Water requirements	Local requirements	31
	Transfers out	1
	Total	32
Balance		**4**

There is a small surplus in the Mdloti Key Area. However this is based on a transfer out of only 1 million m^3/annum. There is a dire need for additional water supply to the Mvoti catchment and it is therefore important that the bottle-neck in this

transfer (see **Section 4.4.3)** be resolved in order to increase the supply from the Hazelmere Dam to Stanger. As mentioned in section 4.4, Umgeni Water is planning a new and much larger pipeline to Stanger which will alleviate the situation.

A direct comparison with the NWRS is not possible because the NWRS includes the Mvoti and the Mdloti catchments in a single sub-area. Refer to **Table 4.31** and **Table 4.36** for a comparison with the NWRS.

4.5.6 Water Quality

Erosion problems are prevalent in the upper Mdloti catchment due to settlement patterns, overgrazing, poor agricultural activities and sand mining operations upstream of Hazelmere Dam. This has resulted in rapid sedimentation of Hazelmere Dam, which has lost more than 20% of its original storage capacity. Effluent return flows downstream of Hazelmere Dam and sewage discharges from Verulam have resulted in the eutrophication of the Mdloti River and poor quality water.

Occasional non-compliance by the sugar mills occur but DWAF's regional office is addressing this through co-operation, awareness creation and encouraging responsibility and compliance.

DWAF and the Ilembe District Municipality are implementing sanitation projects in the Ndwendwe area and this should reduce and stop the faecal contamination of the resources.

The eThekwini Municipality currently have a licence to discharge treated sewage at a rate up to 30 Ml/day into the Umhlanga River. This is apparently impacting on recreational activities at the Umhlanga River mouth and due to public pressure the eThekwini Municipality have investigated alternative options of disposing of this waste. One of the alternatives was to pump the water over to the Mdloti River which could have had a positive impact on the water resources of this catchment. However, after considering the alternative, the eThekwini Municipality have decided not to transfer the effluent to the Mdloti River due to the high cost involved. A more cost-effective option which is currently being considered is to transfer the water to the Piesang River, which is a small tributary of the Mgeni River.

4.5.7 Future scenarios

The growth in water requirements in the Mdloti Key Area will probably be limited to domestic and industrial use. New developments in the area, especially along the north coast, the Dube Trade Port and residential development will fuel this growth. Improved water service to rural communites will also increase water requirements in this Key Area. Potential for new water resources development is limited to the raising of Hazelmere Dam, which is a feasible option. The exact timing of this raising has yet to be determined.

The implementation of water conservation and demand management activities should receive attention in the area, which will result in less leaks, sewage

discharges and improved infrastructure. The water quality of the catchments is expected to improve in future, if this objective is implemented.

4.5.8 Summary, key issues and broad strategy

The land use in the Mdloti Key Area consists mostly of dryland and irrigated sugar cane, mostly on communal land. The small urban areas of Tongaat, Canelands, Verulam and Umhlanga are located in this Key Area. Water is transferred out of the catchment to the Mvoti catchment.

There is a small surplus available in the catchment which could be allocated for poverty eradication, but as a first priority water for the increase in urban requirements must be planned for and secured. Considering the severely stressed nature of the Mvoti Key Area, surpluses in the Mdloti catchment could be used to augment the water supply to the Mvoti. This needs to be weighed up against the alternative of developing the resource in the Mvoti catchment. Water resources development in the Mdloti catchment is possible through the raising of Hazelmere Dam and this is the intended source of water to meet increasing urban requirements along the North Coast.

The water quality of the catchment is generally poor due to point source pollution, especially along the coastal strip. The inland regions generally enjoy better water quality but erosion and resultant sedimentation is a problem. However, the point sources of pollution problems are known and DWAF's Regional Office is addressing these.

4.6 MGENI KEY AREA

4.6.1 Introduction

The Mgeni Key Area covers the U20 tertiary catchment. The main water use activities in the catchment are irrigation and afforestation in the upper areas, with domestic and industrial use in Pietermaritzburg. Durban (in the Mlazi catchment) is supplied from the Mgeni System, and hence transfers out of the Mgeni represent by far the largest water use. For the sake of convenience and simplicity, however, Durban's water use has been included in the Mgeni catchment and this is therefore not shown as a transfer out in **Table 4.11**.

The catchment is complex in that it contains a number of dams which are operated as a system. In addition, water can be transferred into the Midmar Dam catchment from the Mooi River catchment via the Mearns transfer scheme. Plans to increase the available water resources in the Mgeni catchment entail increasing the transfers from the Mooi River catchment.

4.6.2 Hydrology

The Mgeni River system has been analysed extensively and a detailed Water Resources Planning Model (WRPM) is available for the system. There have been recent physical changes to the system (raising of Midmar Dam and commissioning of Mearns Weir). To this end, the Mgeni System model was updated as part of the Study to Update the Mgeni System Allocation Tool (MSAT) by Umgeni Water[13]. The hydrological data used for this assessment are based on the Mkomazi-Mgeni-Mooi River Hydrology Update Study[9].

The total area of the Mgeni catchment is 4 441 km^2 with an MAR of 671 million m^3/a[9].

4.6.3 Water requirements

By far the largest water user supplied from this catchment is the eThekwini Municipality (the greater Durban area), which is supplied from the Mgeni System via the Wiggins and Durban Heights Waterworks in Durban. This demand centre is not physically situated in this catchment but has been included in the Mgeni Key Area for the purposes of this ISP since the water requirements are supplied from the Mgeni System (Albert Falls, Nagle and Inanda dams). The second largest domestic/industrial user is the Pietermaritzburg area, which is supplied with water from the Midmar Dam via the Midmar and DV Harris Waterworks. Umgeni Water, in association with eThekwini Municipality, update their projected water requirements on an annual basis. The latest projections, shown in **Figure 4.1,** indicate that water requirements are not expected to increase until 2010. These projections are only for those users supplied by Umgeni Water, ie urban and industrial users, and hence excludes irrigation.

The stable recorded water use, despite increased population in the area, is as a result of the successful implementation of water conservation and demand management by the eThekwini Municipality. However, it is uncertain whether further reductions in water use can be achieved. While there is a risk that these projections are optimistic, since the potential for still further savings through WC&DM is limited, every effort must be made to realise these savings so as to avoid unnecessary restrictions before the Spring Grove Dam is implemented.

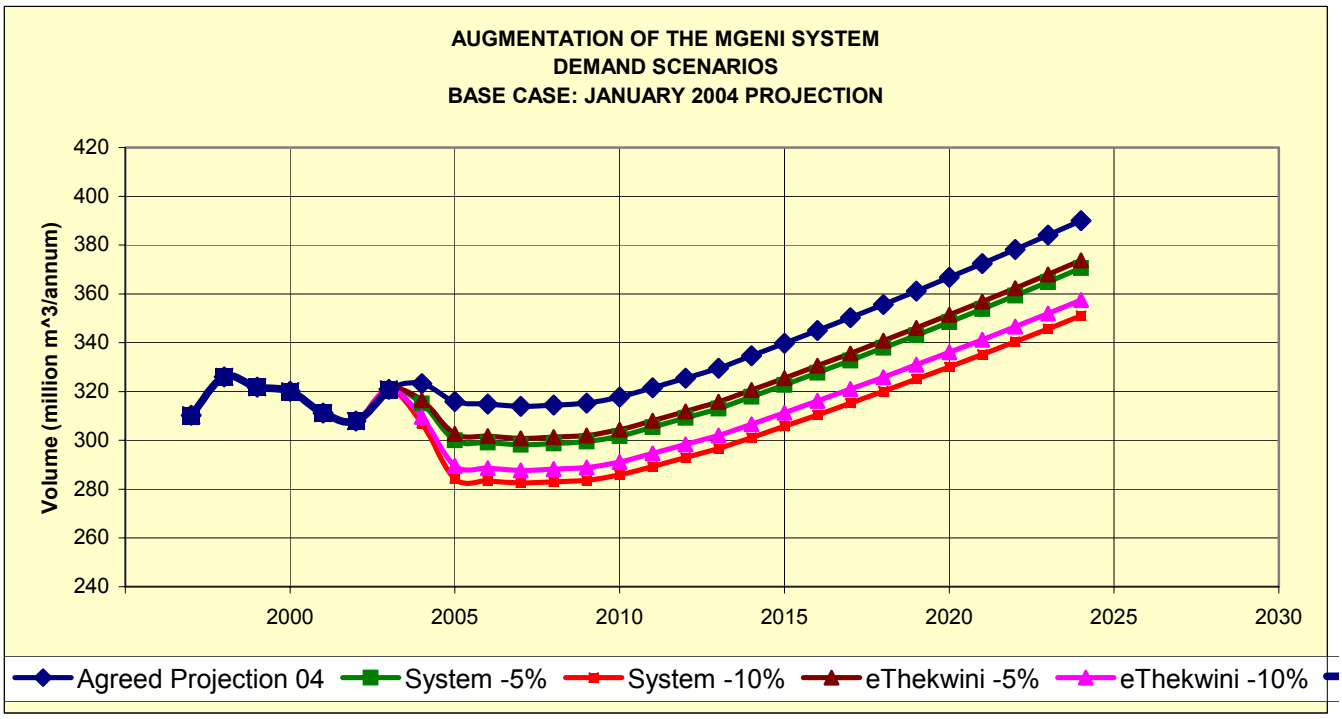

Figure 4.1 : Mgeni Water demand projections (2003).
Source: J Geringer, DWAF

A summary of the present day water requirements is given in **Table 4.11.**

Table 4.11 : Water requirements of the Mgeni Key Area (at a 1:50 year assurance)

Water use activity	Requirement (million m^3/a)
Urban	320
Industrial	4
Rural	9
Irrigation	58
Afforestation	40
Total	431
Transfer out	0
Grand Total	**431**

4.6.4 Water resources

Since the dams in the Mgeni system are operated as a system, it is meaningless to quote the yields of the individual dams, except in the case of the Midmar Dam, which is the most upstream dam in the system and supplies Pietermaritzburg. The 1:50 year yield of the Midmar Dam (raised and with transfers in from the Mooi system) is approximately 130 million m^3/a[16]. While this does not allow explicitly for releases for the ecological Reserve, it does allow for compensation releases of 0,9m^3/s (~28 million m^3/a) and this has been assumed to be an adequate allowance for the ecological Reserve.

The Mgeni system is managed with the aid of the Water Resources Planning Model (WRPM). This model does not specifically indicate what the system yield is but based on the latest analyses using WRPM, augmentation of the system will be required by 2007 while no restrictions are currently in place (see **Figure 4.2**). It can therefore be deduced that the current water requirements are approximately in balance with the available water resource from which the 1:50 year system yield can be deduced. An indication of the water resources is given in **Table 4.12.**

The curtailment levels in **Figure 4.2** are determined from the priority classification table, which is attached as **Annexure D1.** The upper red arrows indicate that there is a 2% probability that by 2006 Level 1 curtailments will have to be applied. Level 1 curtailments cannot be sustained without impacting on the economy of the Mgeni Key Area and it is therefore recommended that the Spring Grove Dam be constructed now so as to augment the Mgeni System by 2007. A summary of the various scenarios considered in the Mgeni System using WRPM are given in **Annexure D2.**

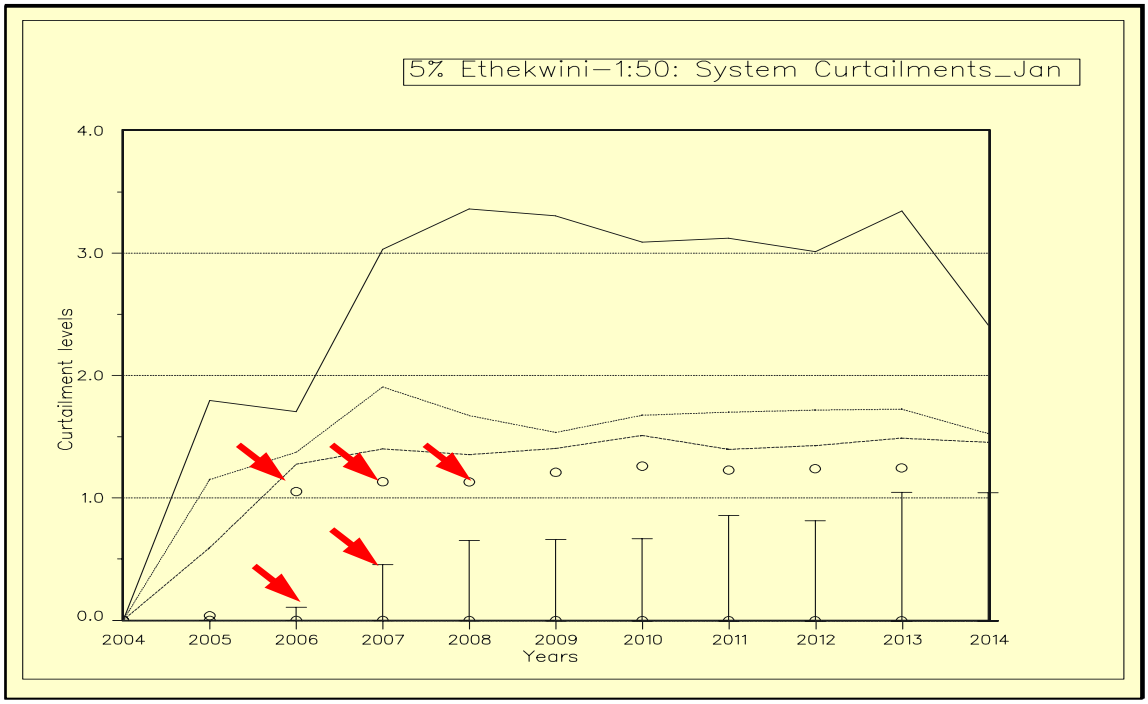

Figure 4.2: Reservoir storage probability plot for the Mgeni system

Source: J. Geringer, DWAF

Key:

Minimum water level out of 200 flow sequences
0,5 % probability line
1% probability line
2% probability line
5% probability line

Table 4.12: Water resources of the Mgeni System (at a 1:50 year assurance)

Resource category	Available/impact (million m³/annum)
Gross surface water resource:	443
Subtract:	
- Ecological Reserve	30
- Invasive alien plants	11
- Dryland sugar cane	25
Net surface water resource	377
Ground water	1
Return flows	15
Total local yield	393
Transfers in	38
Grand Total	**431***

* Derived from the WRPM model to match the current water requirement. See **Table 4.11**

4.6.5 Reconciliation of water requirements and available water resources

Since the Mgeni system is managed over the medium and long-term with the aid of the Water Resources Planning Model (WRPM), the water requirements have been reconciled with the available water resource using this model rather than the WRYM model. While the WRPM uses essentially the same methodology as the WRYM, its output is in the form of probabilities and not single figure numbers which can be easily compared. However, to be consistent with the other Key Areas in the WMA, a water balance table (**Table 4.13**) is given below which shows that the Mgeni Key Area is currently approximately in balance.

Table 4.13: Reconciliation of the water requirements/allocations and the water resource in the Mgeni Key Area catchment (at a 1:50 year assurance)

Available Water	Local yield	393
	Transfer In	38
	Total	431
Water requirements	Local requirements	431
	Transfers out	0
	Total	431
Balance		**0**

The ecological Reserve was not specifically simulated in the WRPM. However, compensation releases and a fixed environmental demand at the estuary were taken into account.

4.6.6 Water quality

In the Mgeni River catchment, there are minor water quality problems in the upper reaches of the catchment. These are due to agriculture, especially small piggeries, feedlots and dairies. The Howick wastewater works and sewer reticulation also pose potential problems, although there is limited general pollution from human activities in the Howick area. Forestry and large-scale sugar cane production with related erosion potential is found in the central area, with limited, reasonably well-controlled pollution from cattle feedlots and poultry operations. There is some intensive vegetable production with resultant nutrient and pesticide problems. Cultivation on steep slopes is common in the moderately populated areas in the Valley of a Thousand Hills which results in moderate to high erosion and some faecal contamination. Dense urban and industrial use occurs downstream of Inanda Dam, with serious faecal and varied industrial contamination likely.

The uMsunduzi River catchment upstream of Pietermarizburg has moderate to serious erosion problems, especially in the Henley Dam catchment. Moderate faecal contamination from the quite dense rural human and animal population and peri-urban settlements around Durban have been observed, although most of this falls outside of the Mgeni catchment. Serious faecal (sewer reticulation and inadequate on-site latrine problems) and general urban pollution arises from Pietermaritzburg, with potentially very serious industrial pollution and significant nutrient enrichment.

The Potential Health Risk Index (E. coli index), derived from the national DWAF Pollution Health Risk Index, shows the Mgeni catchment to have a low to moderate pollution health risk, with the lower Mgeni being the most impacted. The Mgeni catchment is classified as being eutrophic. It is characterised by the growth of aquatic plants and blooms of blue-green algae especially during summer months. This is also observed upstream of Inanda Dam, which is notorious for water hyacinth.

4.6.7 Future scenarios, key issues and broad strategy

The Mgeni River System is fully developed and augmentation of the system will require additional transfers into the catchment. A strategy is proposed (see **Strategy CSS 3.1**) to ensure the continued supply of water to the Mgeni River catchment to meet the growing demands which are expected to result from population and economic growth. This entails the construction of the Spring Grove Dam on the Mooi River, targeted for completion in 2007, followed at some time in the future by a scheme to transfer water from the Mkomazi River catchment to the Mgeni River system. The Spring Grove Dam will increase the Mgeni system yield by an estimated 61 million m^3/a[16]. Following on from this, there are a number of large feasible dam sites on the Mkomazi River and a major dam on this river will secure the water resources for Durban and Pietermaritzburg far into the future. The NWRS has earmarked the water resource of the Mkomazi River for this purpose.

The implementation of a scheme on the Mkomazi will be time consuming and very costly. The medium-term strategy is therefore to carefully monitor the water use in the Mgeni system in order to timeously implement the proposed Mkomazi scheme without exposing the Mgeni system to excessive risks of water shortages which would have serious economic consequences. The timing of these schemes is difficult to estimate and implementation should be delayed for as long as possible due to the large capital expenditure associated with them. Lead times for large schemes such as that planned on the Mkomazi River is also long (at least 10 years), so planning must be done far in advance to avoid water shortages in the Mgeni Key Area.

A study is proposed in which all aspects of securing the long-term supply of water to the Mgeni System are to be analysed. This could include updating the hydrology, demand projections, systems models, etc., and reviewing possible augmentation options. The re-use of effluent will need to be considered in more detail in such a study.

One mechanism for delaying expenditure on a major new scheme is the re-use of effluent. Durban, the biggest demand centre in the catchment, has successfully implemented WC&DM initiatives, resulting in reduced demands. These have been achieved mainly through effluent re-use and water-loss management. A 50 Ml/day (18 million m^3/a) recycling plant is operational and supplies the southern industrial zone. However, urban return flows from the Mgeni Key Area are estimated at 52 million m^3/a[3] which leaves scope for additional re-use of effluent. Nevertheless, the situation in the Mgeni Key Area is precarious and needs to be carefully monitored and tight control over WC&DM maintained.

4.7 MLAZI AND LOVU KEY AREA

4.7.1 Introduction

This Key Area comprises the Mlazi and Lovu River catchments (tertiary catchments U60 and U70). Water use in these catchments is dominated by irrigation in the upper reaches and by the domestic and industrial sector of eThekwini Municipality (Durban) in the lower reaches (predominantly quaternary catchment U60F). Durban's industrial and urban use has however been included in the Mgeni Key Area for the purpose of this report.

The water resources of the Mlazi catchment is no longer used to supply Durban, although prior to the construction of the Nagle Dam, Durban was supplied from the Shongweni Dam situated in this catchment.

4.7.2 Hydrology

The latest hydrology for this catchment is from the Mkomazi-Mgeni-Mooi River Hydrology Update Study[9] and is summarised in **Table 4.14.**

Table 4.14 : Summary of the hydrology of the Mlazi and Lovu Key Area

Tertiary catchment	Area (km^2)	Mean annual runoff (million m^3/a)
U60	1 439	184
U70	944	124
TOTAL	**2 383**	**308**

4.7.3 Water resources

The yield from the Mlazi and Lovu catchments is derived mostly from run-of-river, although the Shongweni and Beaulieu Dams do have significant yields. The 1:50 year yield of the Shongweni Dam was estimated in 1994 at 14,3 million m^3/annum[15]. The local yields available from these catchments were deduced from an analysis using the WRYM. This analysis indicates that 7 million m^3/annum surplus water is available at high assurance even after allowing for the ecological Reserve. Based on this surplus and the known water requirements, it is possible to deduce that the net surface water resource is 46 million m^3/annum.

Table 4.15 summarises the water resources of the catchment.

Table 4.15: Water resources of the Mlazi and Lovu Key Area (at a 1:50 year assurance)

Resource category	Available/impact (million m^3/annum)
Gross surface water resource	69
Subtract:	
- Ecological Reserve	12
- Invasive alien plants	2
- Dryland sugar cane	9
Net surface water resource	46
Groundwater	0
Return flows	3
Total local yield	49
Transfers in	0
Grand Total	**49**

4.7.4 Water requirements

The water requirements of the Mlazi and Lovu catchments are summarised in **Table 4.16**.

Table 4.16 : Water requirements of the Mlazi and Lovu Key Area (at a 1:50 year assurance)

Water use activity	Requirement (million m^3/a)
Urban	1
Industrial	0
Rural	3
Irrigation	32
Afforestation	7
Total	43
Transfer out	0
Grand Total	**43**

Other than the large amount of irrigation in the Key Area, the only other significant use is forestry. There is an estimated 308 km^2 of afforestation in the Key Area, which reduces the runoff by an estimated 22 million m^3/a and the available yield by an estimated 7 million m^3/a.

4.7.5 Reconciliation of the water requirements and the available resource

A reconciliation of the water requirements with the available water resource is shown in **Table 4.17**.

Table 4.17: Reconciliation of the water requirements and the water resource in the Mlazi and Lovu Key Area (million m^3/a)

Available Water	Local yield	49
	Transfer In	0
	Total	49
Water requirements	Local requirements	43
	Transfers out	0
	Total	43
Balance		**6**

It can be concluded from the above table that there is a small surplus in the Mlazi and Lovu Key Area. This is consistent with the understanding of the Regional Office and Umgeni Water.

The water balance of the Mlazi and Lovu Key Area is compared with those of the NWRS in **Table 4.33**.

4.7.6 Water quality

The water quality of the Mlazi and Lovu catchments has been greatly modified. This is due to coastal industries, sewage works, waste water works and textile factories in Hammersdale, intensive agricultural activities in the upper Mlazi River, and forestry in the upper Lovu River. The large number of small 'package' sewage treatment plants is a problem in this area since these are too many for DWAF to monitor effectively and their discharge often does not comply with the legal standards. The Mlazi Township is the most densely populated area in South Africa with 7 756 people/km^2. Open spaces that were left during the design of the Township have been occupied by unserviced shacks and low-cost dwellings. The eThekwini Municipality has tried to provide water services to the structured dwellings, however, others are still unserviced. Faecal pollution from these areas and from sewer bursts and leaks is serious in the Mlazi River, Fongozi Stream and Isipingo River.

The water quality problems of the Mlazi catchment are very serious and need urgent attention. Suggested strategies for dealing with this are given in **Strategy GS2 in Part B1.**

4.7.7 Future scenarios

There are no future water resources development proposals for the Mlazi or Lovu catchments and it is unlikely that there will be any increase in the water requirements (bearing in mind that Durban has been included in the Mgeni Key Area), without specific initiatives aimed at utilising the available surplus. This surplus should be earmarked for poverty eradication.

4.7.8 Summary, key issues and broad strategy

The catchment is dominated by irrigation (59 km^2) and afforestation (308 km^2), with irrigation by far the dominant water user. Much of this irrigation use is for

intensive vegetable farming to supply Durban and Pietermaritzburg. This is important from a food supply perspective.

The catchment is largely unregulated. However, large farm dams are present in the upper reaches of the Lovu River. The Shongweni Dam on the Mlazi River has silted up over the years and is now only used for recreational and educational purposes.

The catchment has surplus water available, even taking the ecological Reserve requirements into account. Poverty eradication initiatives should be considered as the first option for utilising this surplus.

There is no urgency for the ecological Reserve determination and compulsory licensing processes in the catchment. Water conservation and demand management should be encouraged to improve or maintain the *status quo*. Trading of water rights and provision of storage could be considered to deal with localised deficits, if any.

The water quality in the catchment is poor, especially in the Mlazi River. However, the point sources of pollution problems are known and the regional DWAF water quality personnel are dealing with these on an ongoing basis. A longer-term pro-active strategy is however required to solve the water quality problems of this catchment.

4.8 MKOMAZI CATCHMENT

4.8.1 Introduction

The Mkomazi River catchment incorporates the entire U10 tertiary catchment (see **Figure 2.1**). The main water uses in the catchment are large industry (SAPPI-SAICCOR situated at the mouth of the catchment), afforestation (widespread) and irrigation (widespread). There are no major dams on the Mkomazi River. However, development of major water resources infrastructure has been reserved in the NWRS for transfers into the Mgeni River System. The upper part of the catchment is used for commercial agriculture. The communal lands are mainly found in the middle part of the catchment. The catchment includes the urban areas of Ixopo, Bulwer, Impendle, Magabheni, Craigieburn and Mkomazi. These are all very small towns with small water requirements.

Water from the lower Mkomazi River, treated at Craigieburn Water Treatment Plant, augments supply to the Middle South Coast and the Umzinto System Supply area.

4.8.2 Hydrology

The Mkomazi River System was recently analysed as part of the study to develop a decision support system for the Operational Planning of the Middle South Coast System by Umgeni Water (Umgeni Water, 2002). The Water Resources Yield Model (WRYM) configured for the Mgeni Water study formed the basis for this ISP.

The MAR of the Mkomazi catchment is estimated to be 1 067 million m^3/a[9]. The catchment area is 4 387 km^2.

4.8.3 Water resources

A yield analysis was carried out on the Mkomazi River catchment using WRYM as part of this ISP study. Details of this analysis are summarised in **Table 4.18.** The WRYM analysis clearly shows that the catchment is stressed, with irrigators in the middle reaches of the catchment and SAPPI-SAICCOR experiencing severe water shortages.

Estimates of the ecological Reserve and detailed modelling carried out with WRYM indicate that the ecological Reserve will have a large impact on the availability of water in the catchment. Considering the catchment is already stressed, the determination and implementation of the ecological Reserve will require careful consideration.

The estimate of the water resources of the Mkomazi WMA is the same as that of the NWRS.

Table 4.18: Water resources of the Mkomazi Key Area (at a 1:50 year assurance)

Resource category	Available/impact (million m^3/a)
Gross surface water resource	61
Subtract:	
- Ecological Reserve	32
- Invasive alien plants	1
- Dryland sugar cane	1
Net surface water resource	27
Ground water	1
Return flows	3
Total local yield	31
Transfers in	0
Grand Total	**31**

4.8.4 Water requirements

The water requirements in this catchment were taken from the Mooi-Mkomazi-Mgeni hydrology update study[9] since this appears to be the most reliable source of data in the catchment. It appears that this report was not yet available at the time the WRSA reports were prepared and it was these WRSA reports which formed the basis of the NWRS. In consequence the estimated water requirements given in this ISP report deviate significantly from the NWRS estimates.

The estimated water requirements of the Mkomazi River catchment are given in **Table 4.19**. Due to the significant differences to the NWRS, these figures are included for comparison purposes.

Table 4.19: Water requirements of the Mkomazi River Key Area (at a 1:50 year assurance)

Water use activity	Requirement (million m^3/a)	
	ISP	NWRS
Urban	1	1
Industrial	44	53
Rural	5	5
Irrigation	43	33
Afforestation	10	6
Total	103	98
Transfer out	2	1
Grand Total	**105**	**99**

The two large water users in this catchment are SAPPI – SAICCOR, abstracting water from run-of-river at the river mouth, and irrigators, who utilise water, also mostly from run-of-river, throughout the catchment. The irrigation requirement was estimated in the DWAF 1999 study to be 52 million m^3/a. Adjusting this to an equivalent 1:50 year requirement for comparison with the NWRS gives a requirement of 43 million m^3/annum, yet the NWRS estimated 33 million m^3/a. While there is a significant reduction in runoff due to afforestation (52 million m^3/a), the impact of this on the available yield is only about 10 million m^3/a.

Despite the significant discrepancies in the sector water requirements, the total requirement estimated in the ISP report is very similar to that of the NWRS.

4.8.5 Reconciliation of water requirements and available water resources

A reconciliation of the water requirements with the available water resource is shown in **Table 4.20**.

This reconciliation is very much in line with the NWRS which gives the deficit as 68 million m^3/a (see **Table 4.33).** This is confirmed to a large extent by anecdotal evidence and the water supply difficulties which SAPPI-SAICCOR experience. The issue is dealt with in **Strategy 5.1**.

Table 4.20: Reconciliation of the water requirements/allocations and the water resources in the Mkomazi Key Area (million m^3/a)

Available Water	Local yield	31
	Transfer In	0
	Total	31
Water requirements	Local requirements	103
	Transfers out	2
	Total	105
Balance		**(74)**

4.8.6 Water quality

The Mkomazi catchment has minor problems with erosion in the upper reaches of the catchment, but these are more serious in the Impendle subsistence agriculture area, where animal and human populations may also cause faecal contamination. Extensive forestry and general commercial agriculture occurring in the central area (Bulwer to Highflats) and in the Elands River catchment result in limited erosion and nutrient problems. Overall, the water quality of the Mkomazi River is good with few significant problems.

4.8.7 Future scenarios

There is no significant future growth expected in the industrial sectors in the catchment. Growth in the user requirement is probable in the domestic sector due to provision and improvement of services in the rural and predominantly black inhabited areas, which include the coastal townships and peri-urban areas that fall within the Mpambanyoni to Umzumbe River catchments. These will however be small additional requirements. The communal lands in the inland region will be best supplied from groundwater, which is under-utilised in the catchment.

Water resources development for major infrastructure in the Mkomazi Key Area has been reserved for water transfers to the Mgeni System through the proposed future Smithfield and Impendle dams. This does not imply, however, that such a scheme would be soleley for the benefit of users in the Mgeni System. The serious water shortages experienced by SAPPI-SAICCOR could also be resolved through such a scheme. Provision would also be made for the ecologcial Reserve.

SAPPI-SAICCOR have for some time been contemplating constructing a dam to secure their water supply. In the interim they continue to construct temporary weirs across the river near the mouth during sever droughts. This effectively stops all flow to the estuary and cannot be sustainable on an ecological basis.

4.8.8 Summary, key issues and broad strategy

The two largest water users in the catchment are industry, with SAPPI-SAICCOR's large water requirement of 44 million m^3/a at the mouth of the Mkomazi River, and the irrigation sector. There is an estimated 81 km^2 under irrigation in the catchment with an equivalent 1:50 year requirement of about 43 million m^3/a. Forestry is also a significant user of water with 446 km^2 under afforestation which reduces the available yield by an estimated 10 million m^3/annum. There is also an estimated 69 km^2 under dryland sugar cane but this has a very limited impact on the available resources.

Despite the large natural runoff of the Mkomazi catchment (1 067 million m^3/a), the catchment is stressed and there is no water available for new water allocations, unless accompanied by the provision of new storage. The stressed nature of this catchment is due to the lack of storage and water requirements exceeding the natural low flow of the river. This has serious implications for the ecological Reserve which cannot be met under these circumstances, although this will probably only manifest itself during droughts.

The water quality of the catchment is generally good, especially in the upper reaches of the catchment.

The catchment is unregulated and development of major water resources infrastructure is reserved for the transfer of water to the Mgeni River System. The proposed Smithfield and Impendle Dams have been investigated for this purpose. This proposed scheme would also benefit water users in the Mkomazi catchment.

Long-term water supply solutions for the SAPPI-SAICCOR mill have been investigated before (proposed Ngwadini and Temple dams) but nothing has come to fruition. Ngwadini is a site on the main stem of the Mkomazi River while the Temple Dam is a proposed off-channel dam. SAPPI is the biggest industrial user in the catchment and relies on a temporary barrage for water supply during low flow periods, which is not favoured by DWAF. However, financial considerations may be behind the lack of progress in the construction of a permanent structure. Institutions like Mgeni Water and the Ugu District Municipality have indicated their support for the construction of a dam to supply SAPPI-SAICCOR. This could form part of a regional water supply initiative.

4.9 THE SOUTH COAST KEY AREA

4.9.1 Introduction

This catchment or key area includes the Mzumbe, Mtwalume and Mpambanyoni River catchments (tertiary catchment U80). This area is commonly referred to as the Middle South Coast System. The main water requirements are for domestic water use in both urban and rural sectors.

4.9.2 Hydrology

The hydrology is summarised in **Table 4.21.**

Table 4.21 : Summary of the hydrology of the South Coast Key Area

Catchment	Area (km^2)	MAR (million m^3/a)
U80A	158	30
Mzumbe River (U80B & C)	641	55
U80D	120	23
Mtwalume River (U80E & F)	552	53
U80G	261	35
U80H	243	42
Mpambanyoni River (U80J & K)	555	59
U80L	107	17
TOTAL	**2 537**	**314**

The South Coast System was recently analysed as part of a study to develop a decision support system for operational planning of the South Coast System[(2)]. The WRYM analysis undertaken during this study in 2002 was used for this

assessment, but did not cover the entire Key Area. The areas not covered by this study were therefore analysed using the Rapid Simulation Model. The hydrological data and water requirements used in this ISP report are based on the Southern Kwazulu-Natal Water Resources Pre-Feasibility Study[2].

4.9.3 Water resources

The water resources situation of the South Coast Key Area is summarised in **Table 4.22**.

Although a WRYM model has been set up for parts of the U80 catchment, this model does not explicitly determine the available resource. The Rapid Simulation Model was therefore used for this purpose. The available resources in this Key Area are derived mostly from run-of-river, although there are a few small dams such as the EJ Smith Dam and the Mzinto Dam.

Table 4.22: Water resources of the South Coast Key Area (at 1:50 year assurance)

Resource category	Available/impact (million m³/annum)
Gross surface water resource	25
Subtract:	
- Ecological Reserve	14
- Invasive alien plants	1
- Dryland sugar cane	0
Net surface water resource	10
Groundwater	1
Return flows	1
Total local yield	12
Transfers in	2
Grand Total	**14**

The NWRS combines the South Coast (U80) and Mtamvuna (T40) catchments into a single sub-area referred to as the Coastal sub-area. It is therefore difficult to directly compare the South Coast water resources given in this ISP with those of the NWRS. See **section 4.10.11** where the water resources of the Mtamvuna are included with the South Coast for comparison purposes.

4.9.4 Water requirements

A summary of the water requirements is provided in **Table 4.23.**

A comparison of the irrigation requirements as carried out as part of this ISP project revealed large discrepancies in the estimated requirements. The 1999 hydrology study[13] gives the requirement as a negligible 1,2 million m³/a while the WRSA study[1] estimates the irrigation requirement at 8,2 million m³/a. The WARMS database on the other hand lists the registered water use as 4,2 million m³/a. While it is accepted that registered water use is not always a good indication of

the actual use, in this case it is conveniently falls between the other two extreme estimates and it is accepted as the most likely irrigation requirement of this area.

The urban requirements are those of the towns of Scottburgh, Dududu, Craigieburn, Umkomaas, Pennington, Umzinto and Hibberdene. A rural water requirement was sourced from the WRSA study(1) and is consistent with the NWRS. There is a small industrial requirement (1,2 million m^3/a) related to the Sezela Sugar Mill which abstracts water directly from the run-of-river of the Ifafa River.

See **Table 4.32** for a comparison of the water requirements given in this ISP with those of the NWRS.

Table 4.23: Water requirements of the South Coast Key Area (at a 1:50 year assurance)

Water use activity	Requirement (million m^3/a)
Urban	8
Industrial	1
Rural	5
Irrigation	4
Afforestation	0
Total	18
Transfer out	0
Grand Total	**18**

4.9.5 Reconciliation of water requirements and available water resources

A reconciliation of the water requirements with the available water resource in the South Coast key area is shown in **Table 4.24**.

Table 4.24: Reconciliation of the water requirements and the water resources of the South Coast Key Area (million m^3/a)

Available Water	Local yield	12
	Transfer In	2
	Total	14
Water requirements	Local requirements	18
	Transfers out	0
	Total	18
Balance		**(4)**

See **Table 4.33** for a comparison of the water balance given in this ISP with that of the NWRS.

The water resources study of the Middle South Coast(2) concluded that the catchment as a whole is in balance. However, considering each individual

catchment (most of which are completely independent of each other), it becomes apparent that some of the catchments are stressed and are unable to fully supply domestic and industrial requirements during periods of low flow. One of the problems that were identified by the Middle South Coast study was the high summer season requirements which are due to the influx of holiday-makers to the area.

Possible solutions to this problem have been determined by DWAF and the Ugu District Municipality, and Sezela Sugar Mill. These include supplementing the water supply from other systems, raising Umzinto Dam and moving the Sezela sugar mill's abstraction point to the centre of the Ifafa River which would improve efficiencies of abstraction. The South Coast operating rule which was formulated as part of the South Coast study[2] has optimised this inter-catchment augmentation.

The catchment has no opportunity for growth unless storage is provided since most river systems are unregulated. However, groundwater may be utilised for poverty eradication initiatives where possible.

4.9.6 Water quality

Faecal pollution in the Umzinto area, affecting the Mzimayi River has resulted in high E. coli counts, algae and bad tasting water in the EJ Smith Dam. The cause of this is the inadequately serviced areas and sewer infrastructure in dire need of maintenance.

The South Coast Key Area as a whole also suffers from seasonal load variations to local small treatment plants along the coastal strip. This is due to the seasonality of the tourism industry. The consequence of this is sewage effluent that does not meet the minimum standard. There are no existing strategies for dealing with this and a solution needs to be found by DWAF, the Ugu District Municipality and affected operators. The effluent reuse along the small coastal holiday resorts is often limited.

4.9.7 Future scenarios

There are no definite proposals for future water resources development in the catchment. Some future options for the catchment are the raising of the Umzinto Dam and improving the augmentation supply network to the Middle South Coast System. The South Coast Study[3] only addressed the current situation and proposed improvements to the various run-of-river abstraction works in the Key Area. The water shortages that are likely to occur when the ecological Reserve is implemented still need to be addressed through a second phase study. The possibility of supplying this area by extending the water supply network of the Mgeni system, is favoured by Umgeni while DWAF are of the opinion that the local resources should rather be developed.

4.9.8 Summary, key issues and broad strategy

The South Coast Key Area is a largely undeveloped area with limited water requirements. Forestry and dryland sugar cane are also very limited in the area and are not significant factors from a water resources point of view. The catchment as a whole is experiencing a small deficit, which is experienced by

some of the coastal resorts and the Sezela sugar mill. The water shortages of the urban sector are due to the seasonality of the tourism industry. The water-related infrastructure (including the water resources) cannot cope with the large influx of tourists in December.

Umgeni Water is investigating the option of supplying the entire South Coast from the Mgeni system. While this is an option, local resources need to be investigated in more detail before a decision on this is made since there is scope for the development of the local resources.

The water quality problems in the catchment are due to faecal contamination from over-loaded sewers, poor services in the dense informal settlement around Mzinto and excessive seasonal loads on the small sewage plants during holiday periods. The Ugu District Municipality, DWAF, and affected operators need to develop a strategy for dealing with this problem.

4.10 MZIMKULU KEY AREA

4.10.1 Introduction

The Mzimkulu River catchment covers the T50 tertiary catchment. The catchment includes the urban areas of Underberg, Himeville, Creighton and Harding although Port Shepstone, situated in the T40G catchment (Mtamvuna), is supplied from the Mzimkulu River.

4.10.2 Hydrology

The Mzimkulu River catchment has an area of 6 678 km^2 and a natural MAR of 1 373 million m^3/annum.

4.10.3 Water resources

Table 4.25 summarises the water resources of the catchment.

Table 4.25: Surface water resources of the Mzimkulu Key Area (at 1:50 year assurance)

Resource category	Available/impact (million m^3/annum)
Gross surface water resource	95
Subtract:	
- Ecological Reserve	56
- Invasive alien plants	3
- Dryland sugar cane	1
Net surface water resource	35
Groundwater	1
Return flows	1
Total local yield	37
Transfers in	0
Grand Total	**37**

The NWRS gives the utilisable water resource of the Mzimkulu sub-area as only 16 million m^3/a which is much less than the 37 million m^3/a of this ISP. While yield analysis has been carried out on the Mzimkulu catchment as part of this ISP, this was only at a reconnaissance level of detail and there are uncertainties relating to this.

4.10.4 Water requirements

A summary of the water requirements of the Mzimkulu catchment is provided in **Table 4.26**. The source of these data is the Southern KwaZulu-Natal Water Resources Pre-feasibility Study (2001) of DWAF[2].

Table 4.26: Water requirements of the Mzimkulu Key Area (at 1:50 year assurance)

Water use activity	Requirement (million m^3/a)
Urban	1
Industrial	4
Rural	16
Irrigation	7
Afforestation	12
Total	40
Transfer out	10
Grand Total	**50**

The largest water user in the catchment is domestic rural use and stockwatering. This was estimated at 16 million m^3/a in the South Coast study but it should be noted that the NWRS gives a much lower figure of 7 million m^3/a. The higher figure is thought to be a more realistic estimate since it is based on a detailed study.

There are large areas of afforestation in the catchment (584 km^2) which results in an estimated reduction in runoff of 80 million m^3/a. This reduces the yield by an estimated 12 million m^3/a, as determined by the Rapid Simulation Model [8]. This estimate is considerably higher than the 3 million m^3/a stated in the NWRS, but the higher figure is thought to be a more realistic estimate.

4.10.5 Reconciliation of water requirements and available water resources

A reconciliation of the water requirements with the available water resource in the Mzimkulu Key Area is shown in **Table 4.27**.

While it may appear that under current conditions there is surplus water available in the Mzimkulu River, there is a deficit which manifests itself with the ecological Reserve not receiving its full requirement. This conclusion is consistent with that of the NWRS which also shows a deficit in this catchment. Reserve estimates were based on desktop estimates and will clearly need to be confirmed before making any major water allocation decisions.

Table 4.27: Reconciliation of the water requirements and the water resources of the Mzimkulu Key Area

Available Water	Local yield	37
	Transfer In	0
	Total	37
Water requirements	Local requirements	40
	Transfers out	10
	Total	50
Balance		**(13)**

4.10.6 Water quality

There are a few minor water quality problems in the upper reaches of the Mzimkulu River catchment due to commercial development and small towns/settlements. Serious to very serious erosion is present in the Eastern Cape portion of the catchment. This is due to the rural population density in this area and poor subsistence farming practices. Local faecal contamination is also a problem. Similar but less severe problems exist in the adjacent KwaZulu-Natal area and also in the lower catchment. Overall though, the water quality of the Mzimkulu River is good.

4.10.7 Future scenarios

The water requirements of the Mzimkulu River catchment are not expected to grow significantly, if at all, in the foreseeable future. There are therefore no plans to develop the water resources of this catchment. It should be noted however that this catchment has huge and largely untapped resources which could be utilised for many purposes. If not reserved for future use, the potential exists to develop the water resources for poverty eradication.

4.10.8 Summary, key issues and broad strategy

This catchment is characterised by relatively large rural use and extensive afforestation (584 km^2), which has a significant impact on the low flow in the catchment. Further afforestation is constrained by the requirements of the ecological Reserve.

Although the catchment is not currently stressed, the implementation of the ecological Reserve could result in water shortages. This will need to be done carefully taking into account the economic and social needs of the catchment.

There are plans to develop forestry on communal land in the Transkei part of the Mzimkulu catchment. Based on current estimate of the ecological Reserve, this will not be possible. A more comprehensive assessment of the ecological requirements is therefore required in this catchment before additional forestry can be considered.

The broad strategy for this catchment is a 'hands-off' management style. There are no major problems in the catchment and no pressing need for change or development. A long-term strategy for this catchment needs to be developed.

4.11 MTAMVUNA KEY AREA

4.11.1 Introduction

The Mtamvuna Key Area covers the T40 tertiary catchment. Although the catchment is largely under-developed, the main water requirements are, surprisingly, domestic; both the urban and rural sectors. The urban requirements are those of the coastal towns Port Shepstone and Margate although Port Shepstone is supplied from the Mzimkulu River in the neighbouring Key Area. The Mtamvuna catchment consists mostly of communal land which explains the large rural water requirement. There are also large areas of afforestation and dryland sugar cane in the catchment.

4.11.2 Hydrology

The MAR of the catchment is estimated to be 426 million m^3/annum (Midgeley, 1994) from a catchment area of 2 216 km^2. Since no existing WRYM analysis is available for this catchment, it was analysed using the Rapid Simulation Model[8].

4.11.3 Water resources

Table 4.28 summarises the water resources of the catchment. In order to facilitate comparison with the NWRS and motivate possible changes, the figures for the NWRS are also given for the Coastal sub-area (which includes the Mtamvuna and South Coast Key Areas).

The surface water resources of the Mtamvuna catchment are derived almost entirely from run-of-river since there are no dams of any significance in this Key Area. Water is however also transferred into this Key Area from the Mzimkulu River to supply Port Shepstone, which is situated very close to the Mzimkulu River and can be conveniently supplied from this source.

Table 4.28: Surface water resources of the Mtamvuna Key Area (at a 1:50 yaer assurance)

Resource category	Available/impact (million m^3/annum)
Gross surface water resource	34
Subtract:	
- Ecological Reserve	18
- Invasive alien plants	0
- Dryland sugar cane	1
Net surface water resource	15
Groundwater	1
Return flows	0
Total local yield	16
Transfers in	10
Grand Total	**26**

While the NWRS does give water resources figures for the Mtamvuna catchment (they are included with the U80 catchment in the Coastal sub-area – see **Table 4.31**) it is clear from **Table 4.28** that the NWRS has underestimated the available resources in the Coastal sub-area.

4.11.4 Water requirements

The water requirements of the catchment are summarised in **Table 4.29**. The source of these data is the Southern KwaZulu-Natal Water Resources Pre-feasibility Study[2]. According to this source, there are relatively large rural water requirements, significantly larger than those given in the NWRS. The urban requirements are those of Margate, Port Edward, Port Shepstone and Izingolweni. Port Shepstone actually receives its water from the Mzimkulu River and this is shown as a transfer into the catchment (see **Table 4.29).**

Table 4.29: Water requirements of the Mtamvuna Key Area (at 1:50 year assurance)

Water use activity	Requirement (million m^3/a)
Urban	11
Industrial	0
Rural	9
Irrigation	0
Afforestation	1
Total	21
Transfer out	0
Grand Total	**21**

The NRWS has grouped the Mtamvuna catchment with the U80 tertiary catchment and referred to this as the Coastal sub-area.

4.11.5 Reconciliation of the water requirements and the water resources

Table 4.30 provides a reconciliation of the water requirements and water resources of the Mtamvuna River catchment.

Table 4.30: Reconciliation of the water requirements and the water resource in the Mtamvuna Key Area (million m^3/a)

Available Water	Local yield	16
	Transfer In	10
	Total	26
Water requirements	Local requirements	21
	Transfers out	0
	Total	21
Balance		**5**

The more detailed analysis carried out as part of this ISP indicates that the Coastal sub-area, as referred to in the NWRS is approximately in balance, with a small surplus in the Mtamvuna catchment and a small deficit in the U80 catchments.

4.11.6 Water quality

Other than Port Shepstone, there is no significant activity in the Key Area which can result in water quality problems and no serious problems associated with Port Shepstone has been noted.

4.11.7 Summary, key issues and broad strategy

The Mtamvuna catchment is a largely undeveloped catchment. The only significant water requirement is that of the coastal towns which are mostly supplied through transfers from the Mzimkulu River. There are large areas of dryland sugar cane in the catchment (254 km^2) but the reduction in runoff due this has little impact on the available yield because of its location along the coast. Irrigation in the catchment is insignificant.

The catchment has surplus water and presents an opportunity for poverty eradication.

The catchment area straddles the Eastern Cape and KwaZulu-Natal Provinces and management of the catchment is problematic due to the split responsibilities. The KwaZulu-Natal regional office is the *de facto* manager of the catchment.

4.12 SUMMARY

The tables which are provided in this section summarise the water resources, requirements and the reconciliation between the two for the whole Mvoti to Mzimkulu WMA.

Table 4.31: Water resources of the Mvoti to Mzimkulu WMA in the year 2003 (million m³/a) at a 1:50 year assurance

Key Area/ Sub Area	Natural resource		Usable return flow	Total local yield	Transfers in	Grand Total	NRWS
	Surface water	Ground water					
Mvoti	26	1	5	32	1	33	
Mdloti	33	0	3	36	0	36	
Mvoti Sub-area	59	1	8	68	1	69	86
Mgeni	377	1	15	393	38	431	
Mlazi & Lovu	46	0	3	49	0	49	
Mgeni Sub-area	423	1	18	442	38	480	414
Mkomazi	27	1	3	31	0	31	31
Mzimkulu	35	1	1	37	0	37	16
South Coast	10	1	1	12	2	14	
Mtamvuna	15	1	0	16	10	26	
Coastal Sub-area	25	2	1	28	12	40	25
Total	**569**	**6**	**31**	**606**	**38**	**644**	**557**

Note: The shaded rows in the table refer to the NWRS Sub-area while the un-shaded rows refer to the Key Areas used in this ISP. The Key Areas are either equivalent to or a sub-division of the Sub-area.

Table 4.32: Water requirements of the Mvoti to Mzimkulu WMA in the year 2003 (million m³/a)

Sector/ Sub-area	Irrigation	Urban	Rural	Mining and bulk industrial	Afforestation	Total local requirements	Transfers Out	Grand Total	NRWS
Mvoti	48	6	7	20	8	89	0	89	
Mdloti	19	3	3	6	0	31	1	32	
Mvoti Sub-area	67	9	10	26	8	120	1	121	118
Mgeni	58	320	9	4	40	431	0	431	
Mlazi & Lovu	32	1	3	0	7	43	0	43	
Mgeni Sub-area	90	321	12	4	47	474	0	474	504
Mkomazi	43	1	5	44	10	103	2	105	99
Mzimkulu	7	1	16	4	12	40	10	50	50
South Coast	4	8	5	1	0	18	0	18	
Mtamvuna	0	11	9	0	1	21	0	21	
Coastal Sub-area	4	19	14	1	1	39	0	39	41
Total	**211**	**351**	**57**	**79**	**78**	**776**	**0**	**776**	**797**

Note: The shaded rows in the table refer to the NWRS Sub-area while the un-shaded rows refer to the Key Areas used in this ISP. The Key Areas are either equivalent to or a sub-division of the Sub-area.

Table 4.33: Reconciliation of water requirements and available water in the Mvoti to Mzimkulu WMA for the year 2003 (million m³/a)

Key Area/ Sub-area	Available water			Water requirements			Balance	NWRS (year 2000)
	Local yield	Transfers In	Total	Local requirements	Transfers out	Total		
Mvoti	32	1	33	89	0	89	(56)	
Mdloti	36	0	36	31	1	32	4	
Mvoti Sub-area	68	1	69	120	1	121	(52)	(32)
Mgeni	393	38	431	431	0	431	0	
Mlazi & Lovu	49	0	49	43	0	43	6	
Mgeni Sub-area	442	38	480	474	0	474	6	(90)
Mkomazi	31	0	31	103	2	105	(74)	(68)
Mzimkulu	37	0	37	40	10	50	(13)	(34)
South Coast	12	2	14	18	0	18	(4)	
Mtamvuna	16	10	26	21	0	21	5	
Coastal Sub-area	28	12	40	39	0	39	1	(16)
Total	**606**	**38**	**644**	**776**	**0**	**776**	**(132)**	**(240)**

Note: The shaded rows in the table refer to the NWRS Sub-area while the un-shaded rows refer to the Key Areas used in this ISP. The Key Areas are either equivalent to or a sub-division of the Sub-area.

4.13 NWRS

This section documents the water resources, water requirements and water balances as documented in the NWRS for easy comparison with this ISP. Differences between the NWRS and this ISP are noted and motivated throughout Chapter 4 of this report and are summarised below.

Table 4.34: Water resources in the year 2000 (million m³/a) as given in the NWRS for the Mvoti to Mzimkulu WMA

Sector/ Sub-area	Natural resource		Usable return flow			Total local yield	Transfers in	Grand Total
	Surface water	Ground water	Irrigation	Urban	Mining and bulk			
Mvoti	68	1	8	5	4	86	0	86
Mgeni	316	1	6	52	1	376	38	414
Mkomazi	27	1	3	0	0	31	0	31
Coastal	11	2	1	0	0	14	11	25
Mzimkulu	11	1	3	0	1	16	0	16
Total	**433**	**6**	**21**	**57**	**6**	**523**	**34**	**557**

Table 4.35: Water requirements in the year 2000 (million m³/a) as given in the NRWS for the Mvoti to Mzimkulu WMA

Sector/ Sub-area	Irrigation	Urban	Rural	Mining And bulk industrial	Power generation	Affore-station	Total local require-ments	Transfers Out	Grand Total
Mvoti	76	9	10	11	0	8	114	4	**118**
Mgeni	63	378	12	4	0	47	504	0	**504**
Mkomazi	33	1	5	53	0	6	98	1	**99**
Coastal	10	19	10	1	0	1	41	0	**41**
Mzimkulu	25	1	7	4	0	3	40	10	**50**
Total	**207**	**408**	**57**	**73**	**0**	**65**	**797**	**0**	**797**

Table 4.36: Reconciliation of allocations and available water in the Mvoti to Mzimkulu WMA for the year 2000 (million m³/a) as given in the NWRS

Sector/ Sub-area	Available water			Water requirements/allocations			Balance
	Local yield	Transfers In	Total	Local requirements	Transfers out	Total	
Mvoti	886	0	86	114	4	118	(32)
Mgeni	376	38	414	504	0	504	(90)
Mkomazi	31	0	31	98	1	99	(68)
Coastal	14	11	25	41	0	41	(16)
Mzimkulu	16	0	16	40	10	50	(34)
Total	**523**	**34**	**557**	**797**	**0**	**797**	**(240)**

Based on the detailed analysis given in Chapter 4, the following major differences to the NWRS strategy are noted and motivated:-

- The industrial requirements of the Mvoti catchment are much higher than given in the NWRS and the available water resource less. The industrial requirements are those of SAPPI and the Gledhow sugar mill and have been confirmed through the registered water use. The water resources have been determined through detailed yield analyses. The conclusion is that the Mvoti catchment is even more stressed than indicated in the NWRS.

- The urban water requirements of the Mgeni system, as determined by Umgeni Water, are considerably less than indicated in the NWRS, while the irrigation requirements are somewhat higher. The water resources, as determined by DWAF through detailed systems analysis[16] is significantly higher than indicated in the NWRS. In addition, new developments such as the raising of Midmar Dam and construction of the Mearns Weir have increased the yield of the system. The result is that in the year 2003 the Mgeni sub-area was experiencing a small surplus balance and not the large deficit indicated by the NWRS.

- The NWRS shows a significant deficit in the Coastal sub-area while the more detailed analysis carried out as part of this ISP shows that the area is approximately in balance. This is due to the available water resource being greater than estimated in the NWRS.

- Return flows, which can contribute to the available resource, are shown in the ISP as being considerably less than in the NWRS, especially return flows from the urban and industrial sectors. The reason for this is that while the volume of return flow is not necessarily disputed, the availability of this as a resource is. The industrial and urban return flows are almost all derived from activities on the coast and most of the return flows are discharged to the ocean. While it is conceivable that these resources could be harnessed through recycling, in the same way that runoff can be harnessed by constructing a dam, these return flows are not currently being used and therefore do not constitute a readily available resource. In the future, however, this will need to be considered as a resources and weighed up against other options.

5 KEY ISSUES AS DOCUMENTED IN THE NWRS

The NWRS lists a number of key issues and strategies for the Mvoti to Mzimkulu WMA. These are summarised below in italics and comment is made on these issues, given the more thorough evaluation made as part of this ISP.

5.1 MVOTI SUB-AREA

Because of the large capital investment required, construction of the proposed Isithundu Dam on the Mvoti River is likely to only be viable if it could be incorporated as part of augmenting the water supply for Stanger and/or for irrigation. As a further option, additional water may also be supplied from the Mgeni River System.

Comment: Alternative options such as small off-channel storage also need to be considered. The water supply situation to industries in the Mvoti catchment needs to be investigated in more detail since the apparently highly stressed situation should be having a much more serious impact on these industries than seems to be the case.

5.2 MGENI SUB-AREA

The availability of water in the Mgeni River System will have to be increased substantially in future. The main options are:

- *Raising of Midmar Dam and Hazelmere Dam*
- *Additional transfers of water from the Mooi River including the construction of the proposed Spring Grove Dam on the Mooi River.*
- *Construction of the proposed Smithfield Dam and possibly also the Impendle Dam, both on the Mkomazi river, for transfer to the Mgeni System.*

Other options which should be considered include removing invasive alien vegetation from the Mgeni River catchment, the possible re-allocation of water (from irrigation and afforestation) and construction of the Isithundu Dam on the Mvoti River to serve the northern coastal areas.

Comment: The Midmar Dam has already been raised, and the Mearns Weir constructed on the Mooi River and additional yield made available to the Mgeni River System. The construction of the Spring Grove Dam should proceed expeditiously since it would be over-optimistic to rely on yet further reductions in water demand due to water conservation and demand management. This ISP has shown that there are small surpluses available in the Mlazi catchment which could be used for poverty eradication.

5.3 MKOMAZI SUB-AREA

The seasonal shortages at SAPPI/SAICCOR could be overcome through the provision of off-channel storage to augment dry-season run-of-river abstractions. As a longer-term solution, water may be obtained from the Smithfield Dam when constructed for augmentation of the Mgeni System.

Comment: As an interim solution, DWAF has approved the construction of temporary weirs on the Mkomazi River.

5.4 COASTAL SUB-AREA

The water supplies to coastal towns could probably most economically be increased through the development of regional water schemes. Seasonal abstractions of water from larger rivers such as the Mkomazi and Mzimkulu Rivers for off-channel storage is more likely to be economical than the construction of conventional dams.

Comment: This ISP report has indicated that there is a small surplus in the Mtamvuna catchment which could be used for poverty eradication.

5.5 MZIMKULU SUB AREA

Indications are that the natural river flow during dry periods may not be sufficient to meet the requirements of the Reserve, because of large numbers of people being dependent on run-of-river abstractions for their basic needs, together with the relatively high requirements for the ecological component of the Reserve. Careful assessment of the Reserve together with judicious implementation management will be required.

Comment: In addition to the above it should be noted that the Mzimkulu is a largely undeveloped catchment with high natural runoff. The potential therefore exists to develop the resource for poverty eradication or transfer to other catchments in the distant future.

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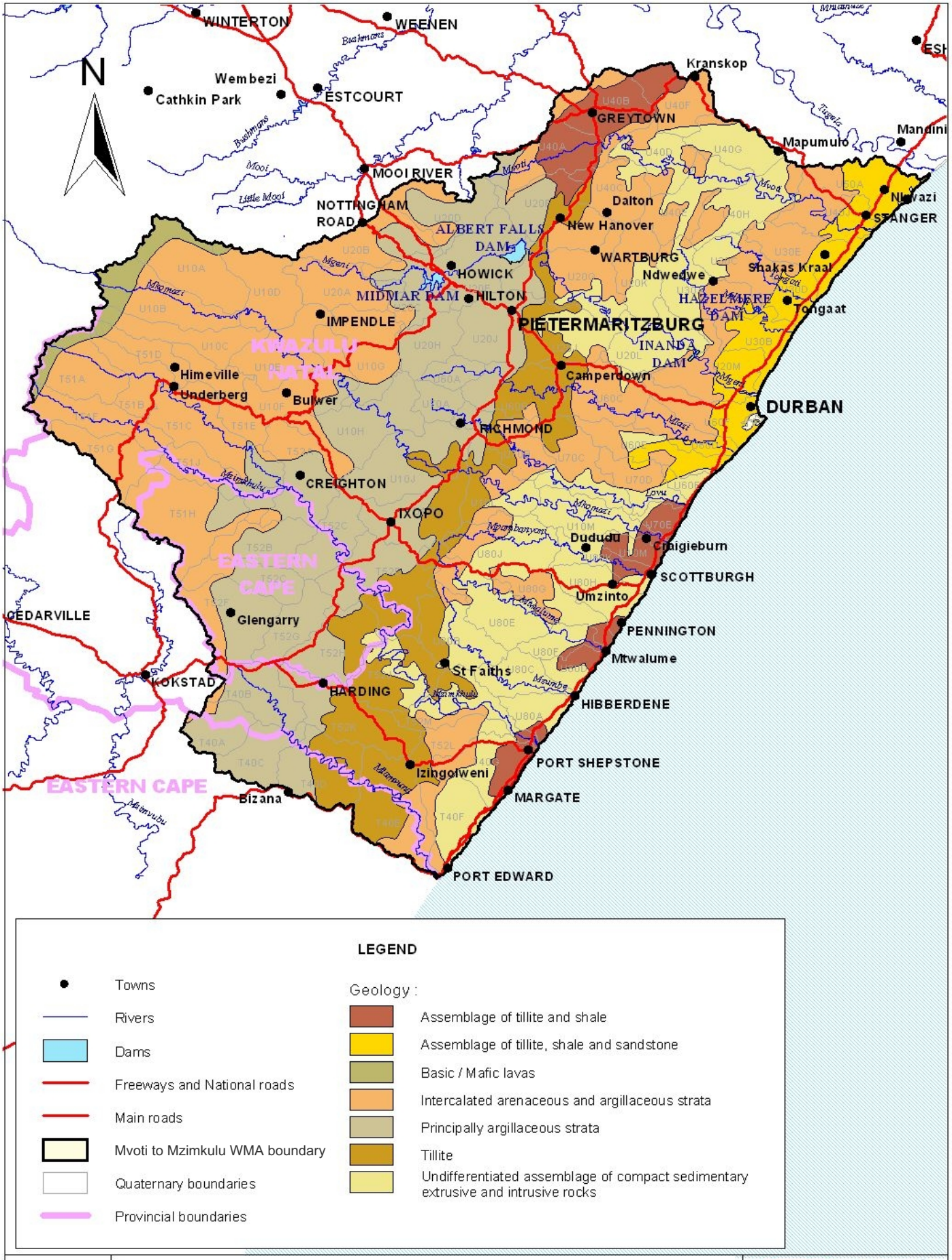
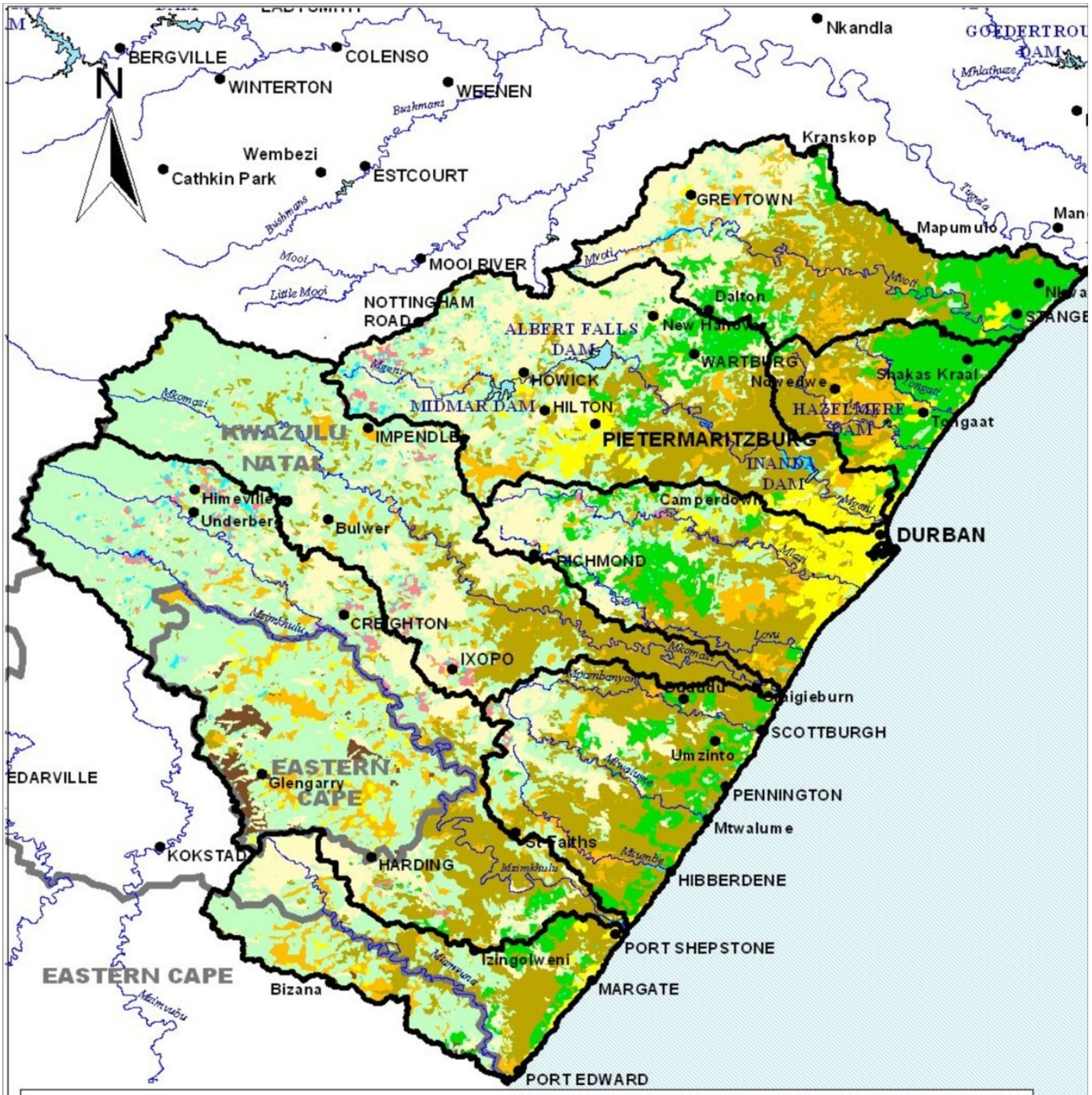
MVOTI TO MZIMKULU WATER MANAGEMENT AREA: INTERNAL STRATEGIC PERSPECTIVE

Figure 2.1: Locality map showing key areas



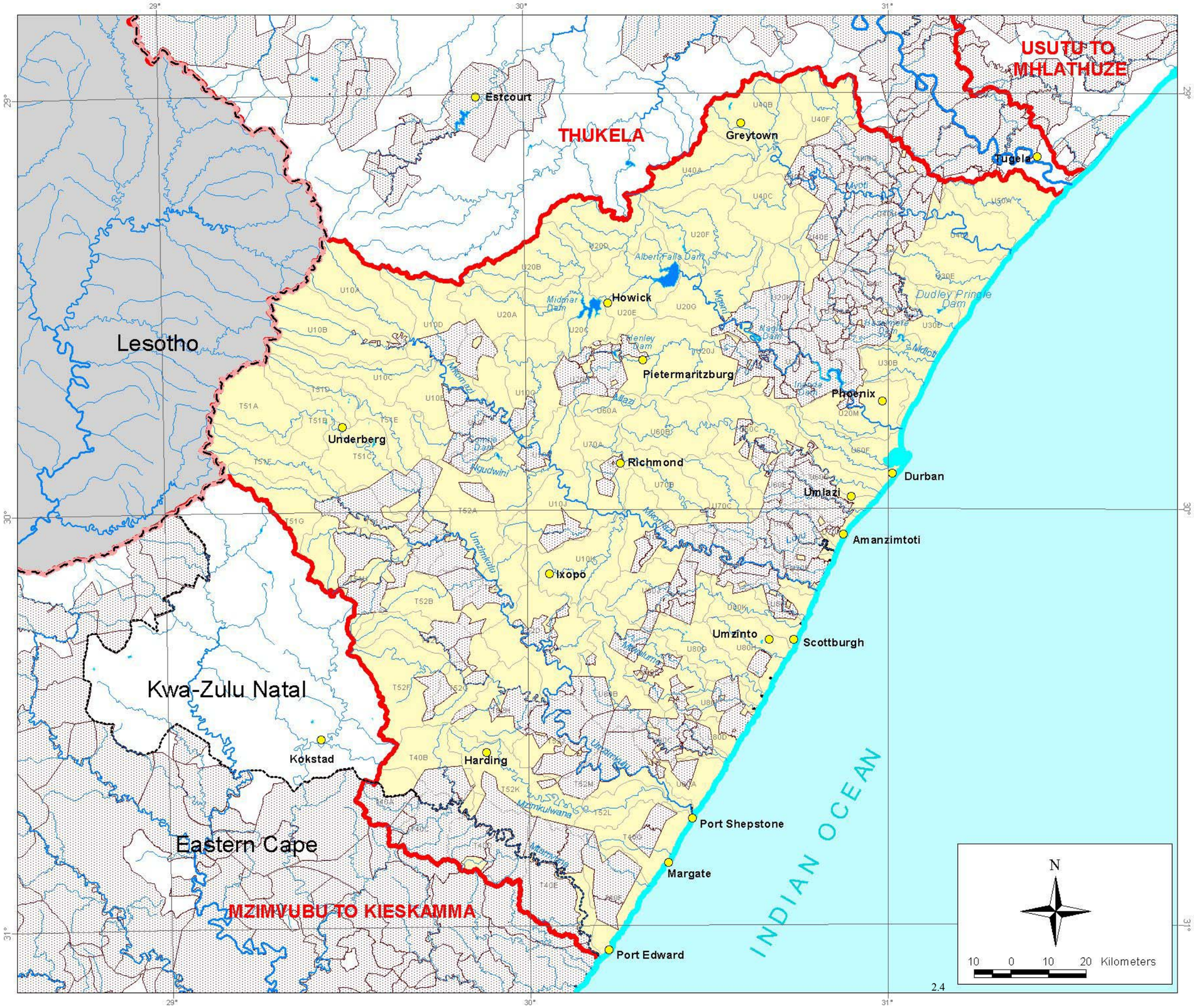
MVOTI TO MZIMKULU WATER MANAGEMENT AREA: INTERNAL STRATEGIC PERSPECTIVE

Figure 2.2: Geology



MVOTI TO MZIMKULU WATER MANAGEMENT AREA: INTERNAL STRATEGIC PERSPECTIVE

Figure 2.3: Overview of land use



LOCALITY MAP:

LEGEND:

- WMA Boundaries
- International Border
- Towns
- Rivers
- Dams
- Tribal area
- Secondary Catchment
- Quaternary Catchment
- U30A Quaternary Number

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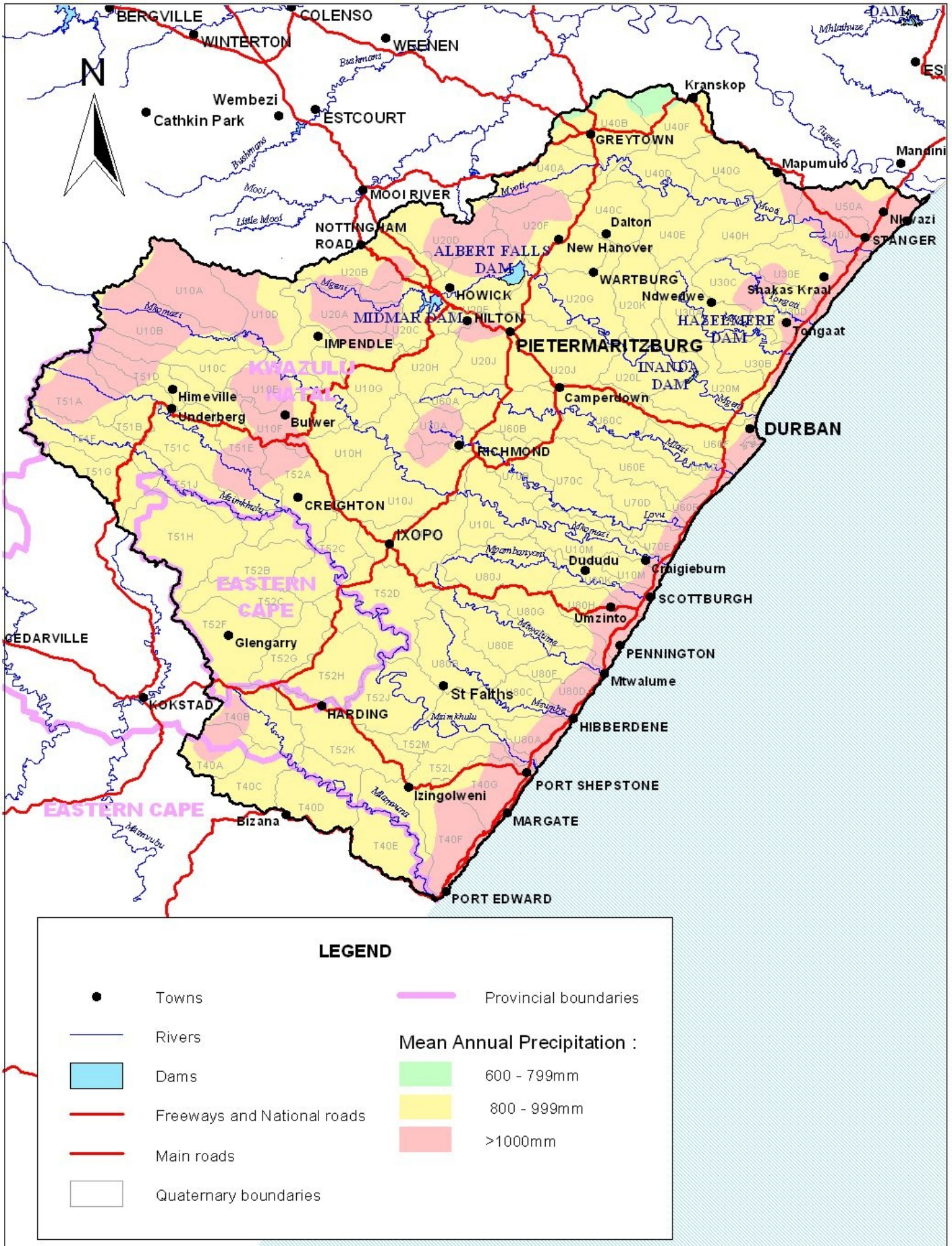
TRIBAL AREAS IN THE MVOTI TO MZIMKULU WMA

Drawn by:	C. Engelbrecht	Figure 2.4
Date:	Febuary 2004	
Map:	d:/.../um voit/settlements.apr	



MVOTI TO MZIMKULU WATER MANAGEMENT AREA: INTERNAL STRATEGIC PERSPECTIVE

Figure 2.5: Rainfall distribution

MVOTI TO MZIMKULU WATER MANAGEMENT AREA : INTERNAL STRATEGIC PERSPECTIVE

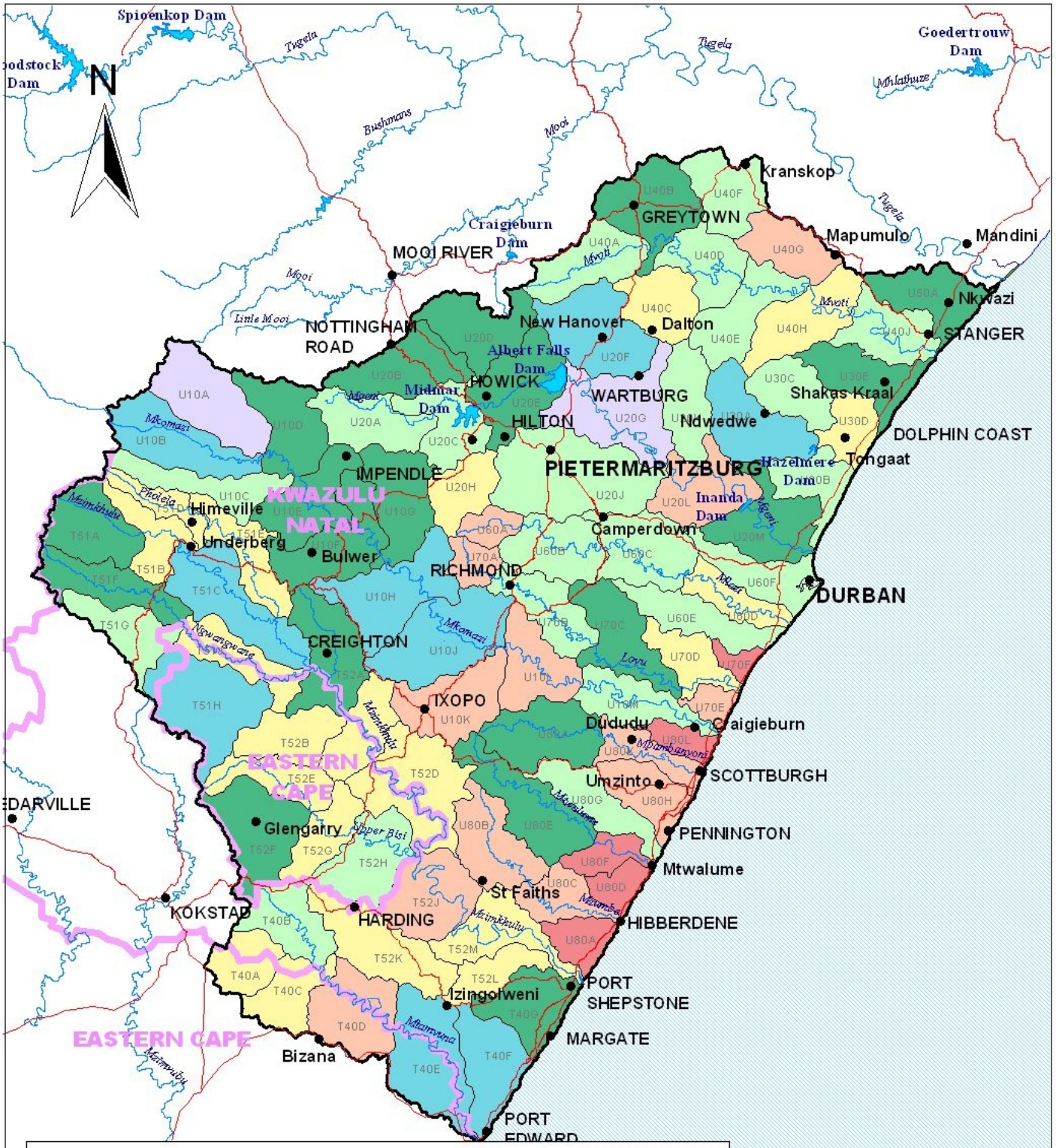
Figure 2.6 : Local Municipalities in the Mvoti to Mzimkulu WMA

MVOTI TO MZIMKULU WATER MANAGEMENT AREA: INTERNAL STRATEGIC PERSPECTIVE

Figure 2.7: Locality map showing district municipalities

MVOTI TO MZIMKULU WATER MANAGEMENT AREA: INTERNAL STRATEGIC PERSPECTIVE

Figure 3.1: Hydrogeological aquifer units



MVOTI TO MZIMKULU WATER MANAGEMENT AREA: INTERNAL STRATEGIC PERSPECTIVE

Figure 3.2: Mean annual groundwater potential

PART B: STRATEGIES

Through existing reports, interviews and workshops, the key issues of the Mvoti to Mzimkulu WMA were identified and strategies developed to resolve these issues with the overarching objective of giving effect to the NWA and the NWRS.

The strategies are divided into two broad categories; those which apply to the whole WMA and those which require more detail to resolve issues that are specific to the catchments which make up the Mvoti to Mzimkulu WMA.

Specific strategies for each catchment were developed to deal with:
Reconciliation of water requirements and the available resource
Water quality management

Catchment Wide Strategies include:

- Water allocation
- Water Quality Management
- Water Conservation and Demand Management
- Groundwater
- Monitoring and information
- Institutional support
- Poverty eradication and co-operative governance
- Alien vegetation
- Forestry
- Implementation

Strategies are structured as follows:

Management Objective
Broad outline of the overall objective of the strategy

Situation assessment
Presents the background information and the relevant issues identified in each catchment. This provides a motivation for the strategy and actions.

Strategy
List of strategic interventions required to fulfil the stated management objective and to give effect to the NWA and NWRS.

Management Action
Specific actions to give effect to the strategies are listed, together with the responsible Directorate/Institution and a priority rating.

PART B1

CATCHMENT SPECIFIC STRATEGIES (CSS)

CSS 1.1: Mvoti Key Area – Reconciliation of water requirements and available resource strategy

CSS 1.2: Mvoti Key Area – Water quality management strategy

CSS 2.1: Mdloti Key Area - Reconciliation of water requirements and available resource strategy

CSS 2.2: Mdloti Key Area - Water quality management strategy

CSS 3.1: Mgeni Key Area - Reconciliation of water requirements and available resource strategy

CSS 3.2: Mgeni Key Area - Water quality management strategy

CSS 4.1: Mlazi & Lovu Key Area - Reconciliation of water requirements and available resource strategy

CSS 4.2: Mlazi & Lovu Key Area – Water quality management strategy

CSS 5.1: Mkomazi Key Area - Reconciliation of water requirements and available resource strategy

CSS 5.2: Mkomazi, Mtamvuna and Mzimkulu Key Areas - Water quality management strategy

CSS 6.1: South Coast Key Area - Reconciliation of water requirements and available resource strategy

CSS 6.2: South Coast, Key Area - Water quality management strategy

CSS 7.1: Mzimkulu Key Area - Reconciliation of water requirements and available resource strategy

CSS 8.1: Mtamvuna Key Area - Reconciliation of water requirements and available resource strategy

CSS 1.1	**RECONCILIATION OF WATER REQUIREMENTS AND AVAILABLE RESOURCES: MVOTI KEY AREA**
MANAGEMENT OBJECTIVE	To attain an equitable and sustainable balance between water requirements and available water resources by progressively implementing integrated water resources management measures. The rationale will be to implement low-cost measures first before investing in the construction of a major dam in this largely unregulated catchment.
SITUATION ASSESSMENT	The water requirements and balance for the Mvoti catchment is discussed in **Section 4.4.** Water use in the Mvoti catchment is dominated by irrigation, with an estimated water requirement of 48 million m^3/a. The other large water users are SAPPI's paper mill and the Gledhow sugar mill, with a total estimated water requirement of 20 million m^3/a. These two industries make use of run-of-river flows near the mouth of the Mvoti River. Forestry and dryland sugarcane also have a significant impact on this catchment, reducing the available yield by an estimated 8 and 4 million m^3/a respectively. The Mvoti catchment is largely unregulated. The only significant dam in the catchment is Lake Merthley near Greytown. There are numerous farm dams, especially in the upper reaches of the catchment (see **Appendix C)**. A reconciliation of the water requirements and available resources shows that the catchment is stressed (see **Section 4.4, Part A)**, and there is no scope for new water allocations. Nevertheless, there is scope for developing the resource, and if accompanied by the construction of new dams, new allocations could be considered. There is also ample groundwater in the catchment which could be used for rural water supply and small-scale irrigation. The implementation of the Reserve will aggravate the already stressed system. However, the Reserve has not yet been determined comprehensively. Desktop estimates put the impact of the Reserve on the available yield at 10 million m^3/annum. Greytown experiences water supply problems but it appears as if these are of an operational nature and not directly the result of a lack of water resources as such. The town of Stanger has the highest urban requirement in the catchment and obtains its water primarily and directly from the Mvoti River. It often experiences water shortages during dry periods. However, the town can be partially supplied from the Hazelmere Dam through Umgeni Water pipelines. Solutions for water shortages in Stanger can also be linked to the development of water resources in the Mdloti catchment, such as the proposed raising of Hazelmere Dam. Potential exists to construct a large dam on the Mvoti River. Investigations undertaken to date indicate the potential to develop a dam, Isithundu Dam, with a capacity of 102 million m^3/annum and a 1:50 year yield of 67 m^3/annum. Potential for an off-channel storage dam in the lower reaches has also been investigated.
STRATEGIC APPROACH	The catchment has very limited opportunity for new water allocations without the development of the resource. Two immediate opportunities which do present themselves are groundwater use, of which there is large potential, and the use of return flows derived from SAPPI and the Gledhow sugar mill at the mouth of the catchment. Currently these return flows are discharged into the river and flow to the sea.

	Urban and industrial water allocations can be met by promoting the following: • implementation of the developed operating rules for Lake Merthley and boreholes supplying Greytown • removal of invasive alien plants in the Lake Merthley catchment • promoting Water Conservation and Demand Management in Stanger and in the irrigation sector • development of the Isithundu Dam, off-channel storage and /or additional transfers from the Mdloti catchment. Additional allocations cannot be made for irrigation or forestry in the catchment unless storage is created. Compulsory Licencing may be the best option to resolve the over-allocation of the resource in the Mvoti catchment. This will probably be required to ensure successful implementation of the Reserve.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Develop and prioritise the compulsory licensing process and develop a water resources allocation plan for the Mvoti Catchment. The prioritisation should be informed by the water requirements for poverty eradication, inequity redress and urban and industrial growth. This ISP does not see this catchment as a high priority for compulsory licensing on a National scale, but it is a priority in the Mvoti to Mzimkulu WMA.	Regional Office, Dir: NWRP Priority: High
Liaise and co-operate with the provincial Department of Land Affairs and Department of Agriculture to identify areas of suitable soils and water availability for resource poor farmers and poverty eradication initiatives, where water can be allocated if small storage dams are provided without negative impacts on the existing lawful use.	Regional Office Priority: High

CSS 1.2	**WATER QUALITY MANAGEMENT STRATEGY: MVOTI KEY AREA**
MANAGEMENT OBJECTIVE	To manage the quality of return flows from irrigation and industry to ensure the proper functioning of the Mvoti riverine ecology and the Mvoti esturine ecology.
SITUATION ASSESSMENT	The only current significant water quality problem in the Mvoti catchment is effluent from the Gledhow sugar mill and SAPPI. The effluents have at times seriously affected the estuary. Despite the large-scale irrigation in the Mvoti catchment, irrigation return flows have not yet resulted in a noticeable deterioration in water quality. There are nevertheless a number of potential problems in the catchment which, if not managed properly, could result in a deterioation of the water to unacceptable levels. These are: • Potential for erosion in the upper catchment due to poor forestry and logging practices. • Faecal contamination in the area of Greytown. • Intensive commercial agriculture with the resulting potential for pollution from pesticides and nutrients. • Serious erosion due to steep slopes and very poor farming practices in the middle reaches of the catchment.
STRATEGIC APPROACH	Effluent return flows from industries need to be monitored rigoroulsy to ensure compliance with DWAF standards. Strong action needs to be taken in cases of non-compliance. The re-use of effluent needs to be investigated as a possible means of reducing the discharge of waste into the Mvoti River. Other potential sources of pollution in the Mvoti catchment need to be carefully monitored and a management strategy put in place to keep these sources of pollutants to within acceptable limits.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Investigate the possible re-use or recycling of industrial effluent near the mouth of the Mvoti River with the objective of reducing waste discharge.	Regional Office Priority: High
Draw up a water quality management strategy for the Mvoti catchment to contain the potential water quality threats of the catchment.	Regional Office Priority: Medium

CSS 2.1	**RECONCILIATION OF WATER REQUIREMENTS AND AVAILABLE RESOURCES: MDLOTI KEY AREA**
MANAGEMENT OBJECTIVE	To attain an equitable and sustainable balance between water requirements and available water resources by progressively implementing integrated water resources management measures.
SITUATION ASSESSMENT	The water requirements and balance for the Mdloti, Mhlali and Tongaat catchments is discussed in detail in **Section 4.5.** The estimated total water use in the Mdloti catchment is 32 million m^3/a. By far the largest water user in the Mdloti catchment is the irrigation sector with an estimated water requirement of 19 million m^3/a, Urban, industrial and rural use makes up the balance. There is no forestry in the catchment but large areas of dryland sugar-cane reduce runoff by an estimated 4 million m^3/a. According to the water balance provided in **Section 4.5**, the catchment is approximately in balance. The most significant water resource developments are the Hazelmere Dam on the Mdloti River and the smaller Dudley Pringle Dam on the Wewe River. Potential exists to raise the Hazelmere Dam and increase its yield by about 26%. A feasibility study on this raising has been completed. The recommendation is to raise this dam in the near future. Due to the undeveloped nature of the Tongaat and Mhlali Rivers, there are surplus summer (wet season) flows available which could be used for irrigating summer crops. The eThekwini Municipality currently have a licence to discharge treated sewage at a rate of up to 30 Ml/day into the Umhlanga River. This is impacting on recreational activities at the Umhlanga River mouth and due to public pressure the eThekwini Municipality have investigated alternative options of disposing of this waste. One of the alternatives was to pump the water over to the Mdloti River which could have had a positive impact on the water resources of this catchment. However, after considering the alternatives, the eThekwini Municipality have decided not to transfer the effluent to the Mdloti River due to the high cost involved but rather transfer the effluent to the Piesang River which is a tributary of the Mgeni River. Water from the Hazelmere Dam, through the Hazelmere Water Works, is used to supply the domestic and industrial requirements of Mdloti, Mhlali and Tongaat catchments, domestic and industrial requirements. Umgeni Water supply water to as far away as Stanger in the Mvoti catchment and are in the process of expanding the water supply infrastructure to this area.
STRATEGY	No immediate action is required in the Mdloti Key Area since there is currently a small surplus. Increased water requirements should be sourced from local sources such as the raising of Hazelmere Dam. The transfer of effluent from the Umhlanga to the Mdloti catchment appears to be too costly as an augmentation option. The possibility of supplying the stressed Mvoti catchment from the Hazelmere Dam should also be considered. Umgeni Water considers this to be a feasible temporary option and are planning a large diameter pipeline to Stanger. Their strategy is to reverse the flow through this pipeline, sourcing water from the possible Isithungu Dam, to supply the future requirements of the North Coast.

MANAGEMENT ACTIONS	RESPONSIBILITY AND PRIORITY
Carefully monitor the growth in water requirements in the Mdloti catchment in order to initiate raising of the Hazelmere timeously.	Regional Office, Dir: NWRP Priority: High
Liaise closely with Umgeni Water regarding their water supply strategies for this area.	Regional Office, Dir: NWRP Priority: High

CSS 2.2	**WATER QUALITY MANAGEMENT STRATEGY: MDLOTI KEY AREA**
MANAGEMENT OBJECTIVE	To manage the catchment in an integrated manner in order to reduce sedimentation and maintain effluent discharges to within the acceptable quality limits.
SITUATION ASSESSMENT	The two main water quality problems in the Mdloti catchment are: • High sedimentation rates due to poor land use management. This has led to the rapid siltation of the Hazelmere Dam. • Effluent return flows downstream of Hazelmere Dam and sewage discharges from Verulam. Return flows from the sugar mills in the Key Area are generally not a problem but occasional incidences of non-compliance do occur. The option of discharging additional effluent from Umhlanga into the Mdloti River is being investigated by the eThekwini Municipality. The assimilative capacity of the Mdloti River is greater than that of the Umhlanga River and such a transfer could have water quality benefits.
STRATEGY	Strive towards better land-use practices in the Key Area through liaison with the relevant provincial authorities with the objective or reducing the high silt-load from the catchment. All point-source discharges must continue to be monitored. Clear procedures for taking legal action in the case of non-compliance need to be established. In the case of industries which co-operate with DWAF, such as the sugar mills, a strategy of co-operation rather than coersion should be adopted.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Liaise with the relevant provincial departments with the objective of reducing the high silt-load from the catchment.	Regional Office Priority: Medium
Continue to monitor point source discharges and take strong action in the case of continued non-compliance.	Regional Office Priority: Medium

CSS 3.1	**RECONCILIATION OF WATER REQUIREMENTS AND AVAILABLE RESOURCES: MGENI KEY AREA**
MANAGEMENT OBJECTIVE	To attain an equitable and sustainable balance between water requirements and available water resources by progressively implementing integrated water resources management measures.
SITUATION ASSESSMENT	The water requirements and balance for the Mgeni catchment is discussed in **Section 4.6** of **Part A** of this report. The Mgeni catchment is the economic hub of KwaZulu-Natal, together with the lower Mlazi catchment in which greater Durban is situated. However, all of Durban's water requirements are supplied from the Mgeni catchment, with the Mlazi itself providing only for local use. The catchment is highly regulated, with four major dams; Midmar, Albert Falls, Nagle and Inanda, the details of which are discussed in **Section 2.6**. Midmar Dam has recently been raised and now has a live storage of 235 million m^3/annum. In addition to this, the Mearns Weir on the Mooi River has been constructed which increases the transferable yield from the Mooi to the Mgeni system. The urban and industrial water requirements in the Pietermaritzburg and Durban surrounds constitute the largest water use in the catchment, estimated at 324 million m^3/annum in 2003. Irrigation is also a large water user, with a requirement estimated at 58 million m^3/annum. Afforestation and dryland sugarcane have a large influence in the catchment, reducing the available yield by an estimated 40 million m^3/annum and 25 million m^3/annum respectively. The eThekwini Municipality predicts that through WC&DM, there will be no further growth in water requirements for the next 5 years. However, given the fact that WC&DM has already reduced water requirements considerably, there is the rislk that further saving s will not be achieved. The total available yield of the Mgeni system are slightly in excess of the available resource. However, based on detailed WRPM analyses, augmentation of the system is required by 2007 if an unacceptably high risk of water restriction is to be avoided. Potential for increasing the yield of the Mgeni System exists through the development of transfer schemes on the Mooi River (Spring Grove Dam) and the Mkomazi River (Impendle and Smithfield dams) within this WMA. The planning and design of the Spring Grove scheme is far advanced and can be implemented at short notice and deliver additional water to the Mgeni System by 2007/2008 if construction commences soon. The catchment is fully allocated and there is currently no potential for additional water allocations for any water use. The issue of equity amongst irrigation allocations will need to be addressed through compulsory licencing or trading. When additional water becomes available through augmentation, this will be available for all users at a market-related tariff. Utilising this expensive water for poverty eradication is therefore not seen as an option in the Mgeni Key Area. Poverty eradication measures should rather focus on other areas where water is more readily available at lower costs. The ecological Reserve has not been determined comprehensively in the Mgeni catchment. Nevertheless provision is made for the ecology in the current operation of the system. Current thinking is that the Mgeni is a 'working river', and that the Reserve needs to be tackled pragmatically to avoid huge economic impacts.

	The urban and industrial water use of Durban and Pietermaritzburg is by far the largest water requirement of the have both regional and national negative economic impacts. Hence, the planning and timing of augmentation schemes for the catchment are critical. The accuracy and reliability of demand growth projections, impacts of WC&DM and hydrology used in the assessment of water resources need to beMgeni Key Area. The shortages of water supply to these areas will based on the most recent data. This needs to be complemented by stakeholder consultation on their plans to deal with these. Durban's WC&DM plans and development plans have the potential of generating new water resources development scenarios and affecting the water tariffs in the catchment. The key stakeholders are DWAF, Mgeni Water, Msunduzi Municipality and eThekwini Municipality. DWAF already work closely with these stakeholders but this cooperation needs to be reinforced to develop future reconciliation strategies for the Mgeni System.
STRATEGIC APPROACH	A decision on the implementation of the Spring Grove Dam is required urgently. All parties (DWAF, Umgeni Water and eThekwini Muncipality) need to be party to this decision. Until such time as the system has been augmented, no further water can be allocated in the Mgeni system. Following the implementation of the Spring Grove Dam, the growth in water requirements in the Mgeni System must be carefully monitored so that augmentation schemes can be implemented in good time. All the necessary planning to ensure the timeous implementation of the next scheme, which, after the Spring Grove Dam, will probably be the Smithfield Dam and transfer tunnel, should be carried out soon. The major water users in the Key Area need to work closely with each other to develop short, medium and long-term reconciliation strategies. DWAF is to build on the existing good co-operation which is already in place. Groundwater could be used for Schedule 1 use. Care must however be taken to understand the groundwater/surface water interaction in the Mgeni catchment. Due to the large storage in the catchment, groundwater use, although limited, will in all likelihood significantly reduce surface water yield and, until it can be proven otherwise, groundwater and surface water should be considered as part of the same total resource. No new allocations are possible until the Mgeni System has been augmented. If there is pressure to address equity with regard to water allocations to the irrigation sector, this will need to be addressed through compulsory licencing. The situation need to be addressed and prioritised within the WMA and nationally. This WMA is not seen as a high priority for compulsory licencing. The ecological Reserve should be phased in gradually with the implementation of these schemes, so as to minimise the impact of the ecological Reserve on the economy of the region.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Together with eThekwini Municipality, Msunduzi Municipality, Umgeni Water and other stakeholders, develop a reconciliation strategy to update demand projection scenarios and criteria, determine the development of new water resources plans, assess the current and planned WC&DM initiatives and agree on operating rules for the catchment.	Regional Office Priority: High
Formalise the procedures for allocation of water for poverty eradication and basic human requirements.	Regional Office and D: WU Priority: Medium

Draw up a programme and budget for the planning process which is required in order to implement the Mkomazi transfer scheme or whatever scheme is decided on to ensure that the water resources are available timeously to meet the requirements of the Mgeni catchment.	D: NWRP Priority: Medium
Investigate the viability of removing more invasive alien plants in the catchment.	Regional Office Priority: High WFW

CSS 3.2	**WATER QUALITY MANAGEMENT STRATEGY: MGENI KEY AREA**
MANAGEMENT OBJECTIVE	To manage the Mgeni catchment in an integrated in order to improve sanitaiton in the catchment and hence reduce the discharge of untreated human waste into the river.
SITUATION ASSESSMENT	The uMsunduzi River in the Mgeni catchment is well known for its poor quality, much publicised through the impact that the poor quality has on competitors in the Duzi Canoe marathon. This is due to serious faecal (sewer reticulation and inadequate on-site latrine problems) and general urban pollution in and around Pietermaritzburg. In addition to this, there exists the threat of very serious industrial pollution. Lower down in the catchment, the dense rural human and animal population and peri-urban settlements around Durban also contribute to the poor quality of the Mgeni River. As a result, the quality of the water in Inanda Dam is poor and is considered to be eutrophic. The result of this poor quality is taste and odour problems and the high cost of dealing with this in the water treatment process. Water hyacinth is also a major problem on the Inanda Dam. Other less conspicuous water quality problems in the Mgeni River catchment are due to agriculture, especially small piggeries, feedlots and dairies. The Howick wastewater works and sewer reticulation also pose a potential problem. Forestry and large-scale sugarcane production with related erosion potential is found in the central reaches of the Mgeni River catchment, with limited, reasonably well-controlled pollution from cattle feedlots and poultry operations. There is some intensive vegetable production with resultant nutrient and pesticide problems. Over-utilised subsistence agriculture, is present in the moderately populated areas in the Valley of a Thousand Hills with resultant high erosion. Some of Durban's sewage effluent is discharged into the Mgeni River near the estuary. This results in high nutrient loads in the estuary but this does not have a major impact on the ecological functioning of the estuary. Of more concern is the threat posed by industrial spills.
STRATEGIC APPROACH	The core water quality strategy in the Mgeni River catchment is to improve sanitation, thus reducing the discharge of human waste. This can best be achieved through co-operative governance and close co-operation with local authorities, who must be held accountable for poor quality effluent discharged from their area of jurisdiction. Point sources of pollution are generally dealt with well. Strategies therefore need to be developed to better deal with diffuse sources.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Through co-operative governance, reduce the poor quality return flow from informal settlements. This can best be achieved through the provision of adequate sanitation.	Regional Office Priority: High
Develop longer-term strategies to deal with non-point source pollution. A water-quality catchment management plan needs to be developed for the Mgeni catchment, which, *inter alia*, needs to deal with the threat of industrial spills.	Regional Office Priority: Medium

CSS 4.1	**RECONCILIATION OF WATER REQUIREMENTS AND AVAILABLE RESOURCES: MLAZI AND LOVU KEY AREA**
MANAGEMENT OBJECTIVE	To attain an equitable and sustainable balance between water requirements and available water resources by progressively implementing integrated water resources management measures. The catchment has a surplus and the rationale will therefore be to allocate it to address the poverty eradication and equity requirements.
SITUATION ASSESSMENT	The water requirements and balance for the Mlazi and Lovu Key Area is discussed in **Section 4.7** in **Part A** of this report. The Mlazi and Lovu Key Area has four main rivers, Mlazi, Lovu, Mbokodweni and Mhlathuzana rivers. The catchment is dominated by agriculture and forestry, with an irrigation requirement of 32 million m^3/annum. There are large areas of forestry and dryland sugarcane which reduce the available yield by an estimated 7 million m^3/annum and 9 million m^3/annum respectively. The large urban requirements of Durban which physically fall within this catchment are supplied by Umgeni Water and have been included in the Mgeni Key Area for convenience. The only other urban requirements are those of the towns of Ixopo and Richmond. The catchment is largely unregulated. The Shongweni Dam on the Mlazi River was lowered and decommissioned as a water supply source for Durban due to safety concerns of the structure. The dam is now under-utilised. The Nungwana Dam in the Lovu catchment supplies Amanzimtoti with support from the Mgeni River System's potable water distribution network, and also supplies the rural scheme of Mbumbulu through the Mbumbulu Water Treatment Plant. The catchment has a small surplus, after making provision for the ecological Reserve and there is hence potential for new water allocations in this catchment. However, the surplus is mainly due to the under-utilised Shongweni Dam and is only available in the lower reaches of the catchment due to the yield from this dam and large return flows from the urban water use, supplied from the Mgeni system. The upper reaches of the catchment have deficits due to intensive afforestation and irrigation. The small town of Richmond in the upper Lovu catchment is the only urban area with urban requirements. The water requirements of Richmond is not mentioned in any of the sources used for this study and it appears as of the NWRS lumped this town with Pietermaritzburg or Durban. The town receives its water from the Beaulieu Dam which is owned and operated by the local irrigation board. There are no proposed future water resources development plans for the catchment outside of the irrigation-related development by established farmers. Low-cost housing schemes are planned for the area but the construction dates are unknown. It is envisaged that water for these developments will be supplied by expanding the Umgeni Water supply network.
STRATEGIC APPROACH	The surplus in the lower reaches of the catchment makes this catchment suitable for further water allocations, especially for poverty eradication. These initiatives do not necessarily have to be related to direct water use. The catchment is suitable for forestry and dryland sugarcane, and since these activities use considerably less water than irrigation, should be considered as a first option. The appropriate authorities need to be informed about these opportunities. Priority should be given to poor resource or emerging farmers when allocating the available surplus in the catchment. Water allocations for large-scale commercial agriculture can also be considered if

	accompanied by the provision of additional storage.

MANAGEMENT ACTIONS	RESPONSIBILITY AND PRIORITY
Liaise and co-operate with the provincial Department of Land Affairs and Department of Agriculture, National African Farmers Union to identify areas of suitable soils in the lower reaches of the catchment and water availability for resource poor farmers and poverty eradication initiatives, where water can be allocated.	Regional Office Priority: Medium
Liaise with the Forest Industries Association and the Sugar Association to help identify land for possible forestry and dryland sugarcane development in the lower reaches of the catchment.	Regional Office Priority: Medium
Promote productive and sustainable use of water by emerging farmers through calls for applications, advertising areas with surpluses and supporting these through the WUAs	Regional Office Priority: High

CSS 4.2	**WATER QUALITY MANAGEMENT STRATEGY: MLAZI AND LOVU KEY AREA**
MANAGEMENT OBJECTIVE	To improve the water quality of the Mlazi catchment to within acceptable norms through the installation of adequate sanitation service to all unserviced areas.
SITUATION ASSESSMENT	The water quality of the Mlazi catchment has been greatly modified and is generally very poor. This is due to the fact that most of Durban is situated in this catchment and there are large urban and industrial return flows. The natural runoff of the Mlazi catchment is small and hence the assimilative capacity of this catchment is very limited. Specific problems in the Mlazi catchment are: • Discharges from coastal industries • Discharge from sewage works • Discharged from textile factories in Hammersdale • Intensive agricultural activities in the upper Mlazi River • The large number of small 'package' water treatment plants is a problem in this area since there are too many for DWAF to monitor effectively and their discharge often does not comply with the legal standards. • The Mlazi Township is the most densely populated area in South Africa with 7 756 people/km^2. Open spaces that were left during the design of the Township have been occupied by unserviced shacks and low-cost dwellings. Faecal pollution from these areas and from sewer bursts and leaks is serious in the Mlazi River, Fongozi Stream and Isipingo River. The water quality of the Lovu River is good by comparison with the Mlazi and is only impacted on by irrigation and forestry in the upper Lovu River.
STRATEGIC APPROACH	The water quality problems of the Mlazi catchment are very serious and need urgent attention. Point sources are already being dealt with adequately by DWAF. The diffuse pollution from unserviced stands needs to be dealt with through co-operative governance and by holding the responsible local authority responsible for the poor water quality.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Improve the level of sanitation in the Mlazi catchment through co-operative governance. Sewage reticulation to be installed in unserviced areas as a matter of highest priority.	Regional Office Priority: High

CSS 5.1	**RECONCILIATION OF WATER REQUIREMENTS AND AVAILABLE RESOURCES: MKOMAZI KEY AREA**
MANAGEMENT OBJECTIVE	To attain an equitable and sustainable balance between water requirements and available water resources by progressively implementing integrated water resources management measures, whilst taking account of the reservation of water resources development for water transfer to the Mgeni River System.
SITUATION ASSESSMENT	The water requirements and balance for the Mkomazi catchment is discussed in **Section 4.8.** The Mkomazi catchment is dominated by irrigation and afforestation in the upper reaches, with an estimated irrigation requirement of 43 million m^3/annum and a reduction in yield due to forestry of 10 million m^3/annum. The largest water requirement in the catchment is however that of the SAPPI plant at the mouth of the Mkomazi River. This water requirement is estimated at 44 million m^3/annum. This is abstracted from run-of-river and is required at a high level of assurance. The Mkomazi catchment is unregulated. Run-of- river abstraction schemes are used to abstract water for SAPPI and for supply to the town of Craigieburn. During severe droughts, SAPPI have in the past constructed temporary weirs across the river. They have applied for a permit from DWAF to construct another such weir. Farm dams on small tributaries of the Mkomazi, especially in the upper reaches, constitute the main water resources development in the catchment. Potential exists to construct large dams on the Mkomazi River. Investigations undertaken to date indicate the most feasible option to be the Smithfield and Impendle dams in the upper reaches of the Mkomazi River. These would be used to transfer water to the Mgeni River system to augment the water supply to Durban and Pietermaritzburg. The NWRS reserves the Mkomazi River for these schemes. Off-channel storage dams in the lower Mkomazi have been investigated to provide SAPPI with a higher level of assurance of supply to do away with the temporary weirs on the main stem of the lower Mkomazi. These options have been found to be feasible but financial constraints are delaying construction of such a scheme. Despite the apparent pristine nature of the Mkomazi River catchment, the water requirements are far in excess of the limited yield and the catchment is severely stressed. The implication of this is that the requirements of the Reserve are not met and that water users receive water at a low level of assurance. SAPPI, at the bottom end of the catchment is worst hit during droughts but seems to manage by constructing temporary weirs. The yield available from these temporary weirs has not been determined. However, if the ecological Reserve of the river and the estuary is to be met and enforced through abstraction control, then SAPPI will definitely not be able to operate through drought periods. Due to the lack of storage in the catchment, there are surplus summer flows which could conceivably be allocated for irrigating summer crops. The stressed situation in the Mkomazi catchment is mostly due to the recognition of the needs of the ecological Reserve and due to the lack of storage which would provide sustainable yield.
STRATEGIC APPROACH	The reservation of the Mkomazi River for possible future transfers to the Mgeni River System must be upheld and any water resources development which is considered in the Mkomazi needs to take these possible schemes into account. Any development must be planned, designed and implemented so as not to rule out the future potential of the Mkomazi as a possible source of supply to the Mgeni

	River system. There is currently no allocable water available in the Mkomazi River catchment, with the possible exception of allocations for irrigating summer crops. This would however need to be carefully controlled. The catchment has significant communal lands, which need water for poverty eradication and these possible summer allocations could be a starting point. No new water allocations to irrigation should be made unless additional water is made available through the creation of storage. Water for small-scale domestic use could be made available from groundwater. If larger allocation are required, construction of small dams on tributaries will need to be considered. The assurance of supply to SAPPI and to urban users near the mouth of the catchment needs to be increased. The construction of an off-channel storage dam in the lower Mkomazi is a feasible option and can best be implemented through co-operation between SAPPI, Umgeni Water and District Municipalities, who will all benefit from such a scheme. DWAF should mobilise this project and play a facilitating and co-ordinating role. There is a need from an ecological point of view to determine the ecological Reserve of the Mkomazi catchment. This is due to the impacts of low flow abstractions, especially at the mouth of the Mkomazi River. However, implementation of the Reserve will need to go hand-in-hand with a permanent solution to SAPPI's water supply problem to avoid huge economic impacts.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Facilitate the development of a permanent solution to water supply problems in the lower Mkomazi instead of the use of a temporary barrage by SAPPI.	Regional Office Priority: High
Liaise and co-operate with the provincial Department of Land Affairs and Department of Agriculture to identify areas of suitable soils and water availability for resource poor farmers and for poverty eradication initiatives.	Regional Office Priority: High

CSS 5.2	**WATER QUALITY MANAGEMENT STRATEGY: MKOMAZI, MTAMVUNA AND MZIMKULU KEY AREAS**
MANAGEMENT OBJECTIVE	To maintain the good quality of the water in these relatively undeveloped catchments and to reduce soil erosion through co-operative governance.
SITUATION ASSESSMENT	The Mkomazi, Mtamvuna and Mzimkulu catchments are all relatively undeveloped and hence do not experience major water quality problems. Overall, the water quality of these catchments is good, with the biggest problem being one of erosion and high silt loads due to poor land management. Other minor problems are related to elevated nutrient loads from irrigation return flows in the upper Mzimkulu and the middle Mkomazi catchments. Extensive forestry in all these catchments results in limited erosion.
STRATEGIC APPROACH	The strategy for the Mkomazi, Mtamvuna and Mzimkulu catchments is to continue with routine monitoring, focusing on areas where there is intense agricultural activity. Efforts must be made to curb soil erosion through co-operative governance aimed at improving land-use practises.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Liaise with the relevant authorities and provincial departments in order to promote improved land-use practises in the Mkomazi, Mtamvuna and Mzimkulu catchments.	Regional Office Priority: Medium

CSS 6.1	**RECONCILIATION OF WATER REQUIREMENTS AND AVAILABLE RESOURCES SOUTH COAST KEY AREA**
MANAGEMENT OBJECTIVE	To attain an equitable and sustainable balance between water requirements and available water resources by progressively implementing integrated water resources management measures. The rationale will be to implement low-cost measures first before developing major infrastructure.
SITUATION ASSESSMENT	The water requirements and balance for the South Coast coastal catchment are discussed in **Section 4.9** in **Part A** of this report. The main rivers in the U80 Key Area are the Mpambanyoni, Mzinto, Mzimayi, Ifafa, Mtwalume and Mzumbe. The water requirements of this Key Area are small compared to all the other Key Areas in the WMA and are dominated by urban (8 million m^3/annum) and rural (5 million m^3/annum) requirements. Irrigation is limited in this Key Area, with an estimated requirement of only 4 million m^3/annum. The Key Area is largely unregulated, with the small EJ Smith and Mzinto dams the only significant dams in the Key Area. These are used for domestic water supply. Potential exists to develop dams on the Mtwalume River and to raise the Mzinto Dam. The Key Area as a whole is currently approximately in balance, although some of the coastal resorts do experience water supply problems during the peak holiday season due to the sudden influx of holiday-makers. However, the Reserve has not yet been implemented and based on Desktop estimates of the ecological Reserve, this will result in the South Coast Key Area as a whole being in deficit. Due to the unregulated nature of the Key Area, there is summer flow available which could be used to irrigate summer crops. Mzinto, Park Rynie, Scottburgh and Sezela Mill constitute the urban and industrial water users in the Key Area and rely on the Mzinto and EJ Smith Dams and run-of-river abstractions from the Mtwalume and Ifafa River. The whole system often experiences water shortages during dry periods and it is augmented from the Mkomazi River via the Craigieburn Waterworks. Rural areas in most parts of the catchment rely on groundwater, except in the Vulamehlo and Jolivet areas, which are supplied by the Vulamehlo Waterworks on the banks of the upper Mtwalume River. An interesting aspect of the Key Area is the success achieved in establishing emerging sugarcane farmers. A significant portion of the sugarcane fields in the Key Area is owned by emerging farmers who have bought Illovo sugarcane farms or used their own communal land to grow sugar-cane after entering into agreements either with Illovo Sugar or with established sugarcane farmers. These farmers supply the Sezela Sugar Mill. Illovo Sugar aims to sell as many of their farms as possible to emerging farmers so as to comply with the competition legislation of South Africa, which discourages the growing, processing and retailing of sugar products by a single corporation.
STRATEGIC APPROACH	The catchment has limited opportunities for poverty eradication and inequity redress unless additional water is made available through the provision of additional storage. Dryland sugar is probably the best option for poverty eradication in this key area. There is no water available for allocation in the South Coast Key Area. However water for basic human requirements could be sourced from groundwater or through provision of new storage. Some of the already identified feasible options for increasing storage are the raising of the Mzinto Dam, or the construction of an off-channel storage dam in the Mkomazi River, which could also supply the South

	Coast Key Area. In the longer term, the construction of the Smithfield and/or Impendle Dams will open up opportunities for a water supply scheme to meet local water requirements, including the U80 Key Area. Irrigation water cannot be made available in the catchment unless storage is created.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Liaise and co-operate with the provincial Department of Land Affairs and Department of Agriculture to identify areas of suitable soils and water availability for resource poor farmers and poverty eradication initiatives. If needed, undertake studies to provide information at the required level of detail.	Regional Office Priority: High

CSS 6.2	**WATER QUALITY MANAGEMENT STRATEGY: SOUTH COAST KEY AREA**
MANAGEMENT OBJECTIVE	To improve the capacity and management of the waste water plants in the South Coast Key Area in order to cope adequately with the influx of tourists over the holiday season.
SITUATION ASSESSMENT	The South Coast Key Area as a whole experiences seasonal load variations to local small treatment plants along the coastal strip. This is due to the seasonality of the tourism industry. The consequence of this is sewage effluent that does not meet the minimum standard during periods of peak load. There are no existing strategies for dealing with this and a solution needs to be found by DWAF, Ugu District Municipality and affected operators. Faecal pollution in the Umzinto area, affecting the Mzimayi River has resulted in high E. coli counts, algae and bad tasting water in the EJ Smith Dam. The cause of this is the inadequately serviced areas and sewer infrastructure in dire need of maintenance.
STRATEGIC APPROACH	An assessment of the capacity of the waste water treatment capacity of the U80 key Area is required and steps must be taken to upgrade these works so as to comply with the standards, even when under peak load. Sanitaiton services need to be provided in the Umzinto area so as to reduce faecal pollution and the eutrophication of the EJ Smith Dam.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Through co-operative governance, embark on a process of upgrading the waste water treatment works in the U80 Key Area in order to comply with the standards.	Regional Office Priority: Medium
Through liaision with the Ilembe municipality, ensure that adequate sanitation is provided in the Umzinto area.	Regional Office Priority: Medium

CS 7.1	**RECONCILIATION OF WATER REQUIREMENTS AND AVAILABLE RESOURCES: MZIMKULU CATCHMENT**
MANAGEMENT OBJECTIVE:	To attain an equitable and sustainable balance between water requirements and available water resources by progressively implementing integrated water resources management measures. The rationale will be to implement low-cost measures first before developing major infrastructure.
SITUATION ASSESSMENT	The water requirements and balance for the Mzimkulu catchment is discussed in **Section 4.11** in **Part A** of this report. The Mzimkulu catchment is an exceptionally large (in terms of runoff) catchment with limited development. There are no major dams in the catchment but several signifcant farm dams, the largest of which is the Glencairn Dam with an estimated full supply capacity of 3,2 million m^3/annum. The water requirements of this catchment are dominated by the rural sector, which, according to the South Coast study, is largely due to stock water requirements. Forestry has a large impact on the water resources of this catchment, reducing the available yield by an estimated 12 million m^3/annum. Making due allowance for the implementation of the ecological Reserve puts the Mzimkulu catchment into a significant deficit. The implication of this is that the ecological Reserve is probably not being met, especially during droughts. Much of the Mzimkulu catchment is unregulated which leaves scope for the possible development of summer crops.
STRATEGIC APPROACH	As with the Mtamvuna River catchment, the Mzimkulu River catchment also presents opportunities for poverty eradication, but again these would need to be either schemes dependent on summer flows or storage would need to be provided. The Mzimkulu catchment could also be reserved for possible future supply to the Mgeni System. These options need to be weighed up at a National level, but considering that the Mkomazi River has been reserved in the NWRS for future use to augment the supplies to the Mgeni Systems, the Mzimkulu catchment should be used for local use.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Undertake a water resources study of the Mzimkulu catchment to identify development opportunities, with the priority given to poverty eradication. This will include liaison and co-operation with the provincial Department of Land Affairs and Department of Agriculture to identify areas of suitable soils.	Regional Office Priority: Medium

CS 8.1	**RECONCILIATION AND ALLOCATION OF WATER REQUIREMENTS AND AVAILABLE RESOURCES: MTAMVUNA CATCHMENT**
MANAGEMENT OBJECTIVE:	To attain an equitable and sustainable balance between water requirements and available water resources by progressively implementing integrated water resources management measures. The rationale will be to implement low-cost measures first before developing major infrastructure.
SITUATION ASSESSMENT:	The water requirements and balance for the Mtamvuna coastal catchment is discussed in **Section 4.10** in **Part A** of this report. The Mtamvuna is a relatively large undeveloped river. The water requirements of this catchment consist almost entirely of urban (11 million m^3/annum) and rural (9 million m^3/annum) requirements. The urban requirements are those of the towns of Port Shepstone, Margate and Port Edward, most of which is sourced from the Mzimkulu catchment and transferred into the Mtamvuna catchment. Although there is some forestry and dryland sugarcane, the impact of this is very limited in this catchment. The catchment is unregulated with no significant dams. There are however a few small farm dams. The catchment is approximately in balance after making allowance for the ecological Reserve. Due to the unregulated nature of the catchment, there is summer flow available which could be used to irrigate summer crops.
STRATEGIC APPROACH	This undeveloped catchment presents opportunities for poverty eradication, although these would either be schemes dependent on summer flows or storage would need to be provided. Other possibilities which need to be explored are afforestation and dryland sugarcane. Although no detailed studies have been undertaken in this catchment, based on the large natural runoff from the catchment there should be ample opportunities for developing schemes which could provide substantial yield.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Undertake a study of the Mtamvuna catchment to identify opportunities for poverty eradication. This will include liaison and co-operation with the provincial Department of Land Affairs and Department of Agriculture to identify areas of suitable soils.	Regional Office Priority: Medium

PART B2

General strategies applicable to the whole Mvoti to Mzimkulu WMA

GS1: Water Quality Management

GS2: Water Conservation and Demand Management

GS3: Groundwater

GS4: Monitoring and information

GS5: Poverty Eradication and Co-operative governance

GS6: Alien vegetation

GS7: Implementation

GS1	**WATER QUALITY MANAGEMENT** (see also the detailed water quality strategies for each Key Area)
MANAGEMENT OBJECTIVE	Ensure a sound and reasonable balance between development impacts and the protection of the resource in terms of water quality, both surface and groundwater.
	Refer also to Chapter 3, Part 1 of the NWRS. The approach to water resource protection in the NWA includes consideration of water quantity and water quality. Water quality management deals with point sources (such as discharges from sewage treatment works or industrial sites) and diffuse sources (such as settlements without a sewage system) of pollution by discharges of waste or water containing waste into water resources. In addition, because of their potential to impact on surface and groundwater resources the Department is, in terms of Section 20 of the Environmental Conservation Act and by agreement with the Department of Environmental Affairs and Tourism, responsible for overseeing the management of solid waste disposal sites where waste is disposed onto land. Decisions about the nature and extent of permissible resource pollution are guided by a hierarchical decision-making framework, which takes account of the balance between the need to protect water resources for sustainable-use, and the need to allow water-polluting activities in order to support social and economic development. The highest priority is to prevent water pollution through waste prevention and reduction, recovery, treatment and final safe disposal. It is however acknowledged that in many cases the discharge of pollutants into water resources is unavoidable, and in these cases the emphasis is on minimising the pollution and its effect on water resources. Where pollution has already caused degradation of water resources, or where contaminated land areas pose a threat to water quality, improvements – remediation – will be effected where it is necessary and practical. Each application for authorisation to discharge wastes into water resources will therefore be preceded by an assessment of the probable impacts of the discharge on the water resources and other water users. For hazardous wastes, the aim is to prevent discharge wherever possible or, if it is not possible, to minimise the extent of the discharge and its impacts. For non-hazardous wastes the receiving water quality objectives approach will continue to be used. The approach assumes that the water environment has a definite and quantifiable capacity to assimilate non-hazardous waste discharged into it without violating predetermined water quality objectives. The assimilative capacity, which will be different for each management class, must be equitably shared among all water users. Wherever possible, best management practices, relating to the treatment and recovery of waste, will be incorporated into licence conditions – source-directed controls – to prevent water resources being polluted. Whilst the overall intention is to prevent further degradation of the quality of the country's water resources, where possible, limited and short-term degradation of the water quality of specific water resources could be allowed if it can be demonstrated with confidence that the degradation will not be irreversible, and that pollution costs are not externalised to other users of the water resources. There are a number of water quality problems in the Mvoti to Mzimkulu WMA. The point sources pollution problems are well understood by the Regional Office but the non-point pollution sources less so. The issues in the WMA include the following and the occurrences of these are detailed in **Part 1: Chapter 4** on a catchment by catchment basis:

- Poor veld management and overgrazing in the middle Mvoti, Mkomazi, Mzimkulu, Mgeni, Mlazi and Mdloti catchments
- Potential groundwater pollution in Durban South from industries
- Sporadic non-compliances of domestic effluent discharges do occur in the Verulam, Stanger, Tongati, and Mzinto areas and from Noodsberg Sugar Mill, Gledhowe and Maidstone mills.
- The discharge of effluent by SAPPI into the Mkomazi River
- Dense settlements with poor sanitation especially in the Mgeni and Mlazi River catchment resulting in high E. *coli* counts
- Irrigation return flows containing high levels of nutrients
- Effluent discharge into the marine environment
- Authorities responsible for sanitation and wastewater infrastructure sometimes do not have the resources to upgrade or even maintain their infrastructure, thus resulting in reduced treatment efficiencies and surcharging sewers.
- Seasonal tourism in the coastal areas results in sewerage plants handling more than their design capacities.
- The DWAF Regional Office is under-resourced and therefore tends to be effective in pollution control as opposed to water quality management.
- The Resource Quality Objectives of the various catchments in the WMA have not yet been determined.

The point pollution sources are well understood and well handled although the local authorities do not always comply. However, they know what is expected of them and the standards which they must comply with. The shortage of financial resources required to operate, upgrade and maintain infrastructure is the major reason for non-compliance.

Users in the WMA need to be informed about the status of the water quality. DWAF, in partnership with the District Municipalities, is implementing sanitation projects throughout the rural areas of the WMA to reduce potential pollution of water resources and improve the health of the communities living in benefiting areas.

Water quality problems in the WMA can best be addressed through co-operative governance between the Regional Office and local authorities. Local authorities must accept responsibility for the quality of effluent arising from state-owned infrastructure in their jurisdiction. Mechanisms need to be put in place to take appropriate legal action against those authorities which consistently do not comply. A financial assistance programme for local authorities is required for the operation, maintenance and upgrade of waste water works.

Diffuse pollution sources from agricultural land and dense settlements require assessment to quantify their impacts, especially in the Mgeni River area. In areas where the problem has manifested itself, these need to be investigated. Monitoring requirements for diffuse sources should be built into the monitoring network (see **Strategy GS 4**). These should be prioritised on an area-by-area basis.

The Regional Office is doing well in managing point sources in the WMA and their efforts should be maintained and improved. The shortage of resources in the Regional Office may discredit these efforts if not urgently addressed.

The water quality situation in the WMA should be continuously monitored and necessary measures implemented to reduce negative impacts. Causes of problems should be understood for the effective design of solutions. The solutions may include poverty eradication measures, land-care activities to reduce sedimentation and improved sanitation.

Proposed water resources developments should accord water quality issues the same serious assessment accorded to water quantity.

	Diffuse pollution sources from agricultural land and dense settlements require assessment to quantify their impacts, especially in the Mgeni River area. In areas where the problem has manifested itself, these need to be investigated. Monitoring requirements for diffuse sources should be built into the monitoring network (see **Strategy GS 4**). These should be prioritised on an area-by-area basis. The Regional Office is doing well in managing point sources in the WMA and their efforts should be maintained and improved. The shortage of resources in the Regional Office may discredit these efforts if not urgently addressed. The water quality situation in the WMA should be continuously monitored and necessary measures implemented to reduce negative impacts. Causes of problems should be understood for the effective design of solutions. The solutions may include poverty eradication measures, land-care activities to reduce sedimentation and improved sanitation. Proposed water resources developments should accord water quality issues the same serious assessment accorded to water quantity.

MANAGEMENT ACTION	**RESPONSIBILITY AND PRIORITY**
Improve co-operation between DWAF: Head Office, the Regional Office, and provincial authorities regarding water quality monitoring and control.	D:WD&D, Regional Office Priority: High
Review water quality monitoring in the WMA and ensure that it is sufficient to manage impacts of diffuse agricultural activities and dense settlements, and incorporate the findings into the Monitoring Strategy.	Regional Office Priority: Medium
Ensure adequate resources are made available to undertake the delegated WQM activities.	Regional Office Priority: High
Determine resource quality objectives for the WMA catchments.	Regional Office Priority: Medium
Progressively work towards customising the General Authorisations framework for catchment-specific authorisations.	Regional Office Priority: Medium

GS2	WATER CONSERVATION AND DEMAND MANAGEMENT
MANAGEMENT OBJECTIVE	Ensure effective and efficient utilisation of the resource by the various water use sectors. This will help delay the need for compulsory licensing in the WMA and for the development of storage infrastructure.
SITUATION ASSESSMENT	The principles of Water Conservation and Demand Management are enshrined in the National Water Act. DWAF has developed a national water conservation strategy and sectoral strategies. Durban and Pietermaritzburg are the only cities which have invested in WC&DM to date, focusing on the urban and industrial sector. DWAF is currently undertaking assessments of the potential of WC&DM in the North Coast (coastal Mdloti and Mvoti catchments) and in the Port Shepstone area. In the Mvoti to Mzimkulu WMA, the urban sector is the largest water user, followed by irrigation. Based on the Durban Metro's successful WC&DM initiatives, there is potential for further urban demand reductions in other urban areas through effluent re-use, infrastructure maintenance programmes and active and/or passive leakage controls. Stanger and Port Shepstone, which both have water supply problems, could achieve significant water savings if they implemented WC&DM measures, while further savings could be achieved in Pietermaritzburg. Based on the findings of a recent WC&DM study undertaken in the Mhlathuze catchment, significant potential water savings can be achieved in the irrigation sector. The capital costs required to achieve this are significant but the cost per cubic metre of water saved would be low compared to other WC&DM options. Installation of efficient irrigation systems, drip irrigation and improved scheduling would save water. The areas which should receive attention as a first priority are those where there is substantial irrigation and where the catchment is already stressed. These areas are: Mvoti (irrigation requirements 48 million m^3/annum) Mgeni (irrigation requirements 58 million m^3/annum) Mkomazi (irrigation requirements 43 million m^3/annum) If the consumptive water use can be reduced by only 10% in these catchments, this would bring about a saving of 15 million m^3/annum. Care would however have to be taken to ensure that water saved is not simply taken up by irrigators by increasing there area under irrigation. Some incentive for irrigators to save water needs to be put in place. The inefficient operation of dams is often a cause of water loss from a system. This is not a known problem in the Mvoti to Mzimkulu WMA, but the operation of the dams in the Mgeni system lends itself to inefficiency. Water is released from Midmar and Albert Falls dams for abstraction at Nagle Dam. If too much water is released it could be lost to the system. The Mvoti to Mzimkulu WMA has a serious problem with invasive alien plants and the removal of these is a WC&DM option. The total area of invasive alien plants in the WMA is estimated at 851 km^2 with large areas of infestation in all the key areas except for the Mkomazi and Mtamvuna cathments which are relatively free from invasive alien plants. From a water resource perspective, the catchments which should be targeted for eradication as a priority are the Mgeni and the Mvoti catchments. Effluent reuse is a possible WC&DM option although the contribution of return flows contributing to the riverine ecosystems needs to be taken into account before reducing these flows. Large return flows which can be targeted for WC&DM are:

	▪ Mvoti (SAPPI and the Gledhow sugar mill): Current effluent return flows could be as high as 15 million m^3/annum. ▪ Durban sewage effluent discharged into the lower Mgeni River: 40 million m^3/annum ▪ SAPPI effluent discharged into the lower Mkomazi River: 35 million m^3/annum. The continued WC&DM efforts of Durban Metro need to be supported by DWAF and the lessons learnt from the successes in Durban applied in other urban centres in the WMA, especially Stanger and Port Shepstone. However, the additional savings that can be achieved from the urban sector in the Mvoti to Mzimkulu WMA are limited and further WC&DM efforts need to focus on the irrigation sector in stressed catchments in this WMA, prioritised as follows: ▪ Mvoti catchment ▪ Mgeni catchment ▪ Mkomazi catchment Reuse of effluent should receive a high priority as a WC&DM measure in this WMA. Priority should be given to the following: ▪ Industrial effluent in the Mvoti catchment ▪ Municipal effluent in the Mgeni catchment ▪ Industrial effluent in the Mkomazi catchment Dryland sugarcane is currently not a declared Streamflow Reduction Activity in terms of the NWA. Moves to have this changed could improve the management and control of the water resources in the WMA, which has as much dryland sugar-cane as afforestation. The area under dryland sugarcane is estimated at 295 km^2. The largest area is in the Mgeni catchment where it has a large impact on the yield of the system, estimated at 25 million m^3/annum, while the impact on the WMA as a whole is estimated at 65 million m^3/annum.
STRATEGIC APPROACH	Dryland sugarcane should be declared as an SFRA as soon as possible to stop the possible uncontrolled expansion of this activity. This will also allow DWAF to stop the planting in riparian zones, over which the Department currently has no control. In the interim, DWAF should co-operate with other stakeholders to ensure compliance of the industry to environmental legislation, observation of river buffer zones and wetlands. Strategies of what to do with water which becomes available through successful WC&DM practices need to be developed. As an interim measure this water should be added to a common pool for possible reallocation. Users who successfully implement WC&DM need to be rewarded in some way and methods to do this need to be developed. Operating rules need to be improved to reduce inefficiencies. This deserves particular attention in the Mgeni and Mdloti catchments, where releases from the dams are made for downstream irrigation purposes. Accuracy in the determination of the requirement, timing of the release, distance to abstraction points and water used are of critical importance. The outputs from the WC&DM situation assessments that DWAF is currently undertaking in the North Coast (coastal Mdloti and Mvoti catchments) and in the Port Shepstone area should be used towards deriving the WC&DM potential in the WMA.

MANAGEMENT ACTION	RESPONSIBILITY AND PRIORITY
Develop and implement measures to improve the efficiency of irrigation, commencing in the Mvoti and Mgeni catchments, followed by the Mkomazi catchment.	Regional Office Priority: High
Liaise with WFW and prioritise the Mvoti and Mgeni catchments for the removal of invasive alien plants.	Regional Office Priority: High
Declare dryland sugarcane as an SFRA.	D: Abstraction and Instream Use Priority: High
Develop strategies to re-allocate water that becomes available from the successful application of WC&DM. This is especially important with savings made by the irrigation sector.	D: Water Use Efficiency Priority: Medium
Initiate a study to investigate reuse of the effluent in the following order of priority:- Mvoti catchment – Sappi and the Gledhow sugar mill Mgeni catchment – Durban's industrial use Mkomazi catchment - Sappi	Regional Office: Priority: High

GS3	GROUNDWATER
MANAGEMENT OBJECTIVE	To improve knowledge of the volume and spatial distribution of groundwater available that can be exploited in a sustainable manner, to determine the potential for further use in providing water to the rural poor and to ensure that groundwater use is accorded appropriate attention in the WMA.
SITUATION ASSESSMENT	The reader is referred to Chapter 3 of **Part A** of the report for a more in-depth discussion of groundwater in the WMA. By far the greater portion of the WMA comprises 'hard rock' secondary porosity aquifers of the 'weathered and fractured' and 'fractured' classes. These areas are characterised by low yields. There are limited occurrences of sandy alluvium underlying the river beds in the immediate coastal portion of the WMA. These are associated with high groundwater potential. This WMA is located in a region of relatively high rainfall with relatively abundant surface water resources. As a result surface water has in the past been used virtually to the exclusion of the very significant groundwater resource which is also available in the region. Groundwater is used to a very limited extent in the region for rural domestic water supply and stock-watering purposes especially where the surface runoff is not as reliable. It is also used as a water supply for some small urban residential areas within the WMA. Use has, however, suffered from a lack of operational sustainability, especially in the rural areas. The estimated present annual groundwater use in the WMA is some 9 million m^3/annum, which is less than 1 per cent of the total mean annual aquifer recharge, being lowest in the low-density populated rural residential and agricultural portions of the WMA and highest in the urban and peri-urban portions of the region. Thus existing groundwater usage in the WMA is very low in terms of the sustainable available resource. Groundwater in the area is used for small-scale urban reticulated water supply, (as at Zinkwazi Beach and Blythedale Beach, and Greytown on an emergency basis), for industrial usage, particularly involving high-yielding screen-wells in the immediate coastal portions of the region (Engen Oil Refinery, Sezela Sugar Mill, Gledhow Sugar Mill, Noodsberg Sugar Mill). It is also used on a limited basis for irrigated horticultural production, as near Richmond, and for rural domestic water supply purposes. In the latter regard, groundwater is already the water source for at least ten rural domestic reticulated water supply schemes in the WMA which have been established, and which have operated for the last few years. Previous attempts over the years at using this resource for this purpose have invariably floundered within a year or two of their commencement due to a lack of continuing operational supervision and maintenance. The supply of water to the rural areas using groundwater is seen as a cheap and cost effective option due to settlement patterns and topography in most of the rural areas within the WMA. This can most satisfactorily be achieved by the involvement of the relevant Local Authorities, the involvement of local communities also being imperative. However, the failures of previous boreholes in many areas have developed the perception of groundwater as an unreliable source. This has been the result of: • the lack of monitoring mechanisms for boreholes • lack of maintenance and maintenance plans for boreholes • incorrectly sited boreholes • general lack of groundwater understanding when compared to surface water

	• poor operating rules • the relative abundance of surface water in the WMA. These factors have created a political reluctance to viewing groundwater schemes beyond emergency supply within the WMA.
STRATEGIC APPROACH	Outside of existing water supply schemes, the utilisation of good quality groundwater is much more cost effective than surface water utilisation. Groundwater should be the first consideration for use before surface water. The low utilisation of this resource in the WMA presents an opportunity. This opportunity needs to be explored further, especially in the stressed catchments to determine implications of its use on surface water, amongst other things. Groundwater may be used for irrigation purposes for poverty eradication, and inequity redress. The groundwater resource is grossly understated and underutilised in the WMA. The District Municipalities, as water authorities and service providers in certain instances, need to be educated about the groundwater value and use. This should be accompanied by the general promotion of groundwater use in this WMA and others in KwaZulu-Natal endowed with abundant surface water. DWAF should also improve its own understanding of groundwater in WMA by regularly updating groundwater information. A strategy for reversing the poor political perceptions of groundwater, created through poor operation and maintenance, are required. The final choice of water as source for any licence or scheme should be fully motivated, most particularly where surface water is preferred over available groundwater. The agencies and drilling contractors who are implementing groundwater schemes in the WMA should systematically provide information on borehole yields and locations to DWAF. The 1995 DWAF groundwater characterisation and mapping for KwaZulu-Natal needs to be updated. It should capture new schemes, groundwater use that has been registered as part of the water use registration process, groundwater utilisation plans in the District Municipalities' WSDPs and poverty eradication projects funded by the various organisations throughout the WMA.

MANAGEMENT ACTION	**RESPONSIBILITY AND PRIORITY**
Assess groundwater use potential in the WMA and quantify current uses, identify users and potential impacts of groundwater use.	Regional Office Priority: High
Develop strategies of promoting groundwater use throughout the WMA.	Regional Office Priority: Medium
Undertake groundwater mapping and characterization update of the WMA. Resources required to undertake such an update should be planned for within a reasonable period of time.	Regional Office Priority: Medium
Engage with a groundwater specialist, agencies providing water services and sanitation in the WMA to get updated information they have.	Regional Office Priority: High

GS4	MONITORING STRATEGY
MANAGEMENT OBJECTIVE	To design and implement an effective monitoring network (quality and quantity) and information management systems to ensure effective and efficient management of the water resources.
SITUATION ASSESSMENT	South Africa no longer has water to spare and many catchments are now stressed –with often more water allocated to users than is reliably available. There is intense and growing competition for water. The true cost of supply and value of water as a resource is now being recognised, and users are starting to pay realistic, rather than nominal charges. There are considerable inequities in the way water has been allocated in the past both in terms of people and the environment, requiring that some reallocation will have to take place. In order to license, allocate and manage this increasingly scarce and increasingly valuable resource requires exact data on volumes available, volumes used and quality. This demands accurate monitoring of rainfall, streamflow and water use. The rain gauging and particularly streamflow monitoring networks in the Mvoti, Mzimkulu, Mtwalume, and Mzumbe catchments are inadequate for the accurate estimation of resource availability and use. This monitoring strategy is required to ensure that systems are put in place at National, Water Management Area, and Catchment level to allow for the effective and efficient management of the resource. Monitoring is an activity usually undertaken by the institution most requiring the information. This often leads to disperse and inefficient information gathering with data of differing standards, and often inaccessible to other interested parties. Information must be correctly processed, brought to a widely acceptable standard and stored within databases, which provide security to the owner but which can also be shared both in terms of input and access. The importance of accurate information for management has been stressed in the National Water Resource Strategy. It is apparent from the NWRS that both National and Departmental monitoring systems are spatially inadequate and often operate largely in isolation of each other. Whilst the Department is actively working to structure its systems into a single 'Monitoring, Assessment and Information System' (MAIS) it is clear that **this** ISP will need to address networks and funding, staff capacity, and co-operative relationships with other organizations. This strategy will also need to ensure that all activities are compatible with the national information system. The important roleplayers in monitoring in this WMA are DWAF, Umgeni Water, the Weather Bureau, and the Sugar Association. DWAF are mostly active in monitoring river flow (quantity and quality) and the state of reservoir storages, Umgeni Water have an active water quality monitoring programme in their area of jurisdiction and also monitor bulk distribution flows. The Sugar Association maintains many if their own raingauges and this information is available to DWAF. Some of the local Municipalities also maintain raingauges. **Monitoring, for the purposes of this strategy, applies to all aspects of the water resource, particularly:** • Hydrology - rainfall, climate, and streamflow • Geohydrology – groundwater • Inflows and outflows (transfers) • Abstraction (water users, dam levels, operational releases, losses etc) • Water quality (surface water, groundwater) • Waste water outflows • River health monitoring

- Monitoring for compliance with the ecological Reserve
- Sedimentation

Supporting information includes:

- Small farm dams (numbers, capacity, use) – this will also require monitoring
- Land use change (agricultural cropping, forestry, invasive alien plants) – data available from other sources, but this needs monitoring
- Return flows.

The situation in the WMA is captured in the following points, which also highlight the gaps.

There is no groundwater monitoring in the WMA. Groundwater monitoring is expensive and resources are limited. However, it is essential to ensure the sustainable use of groundwater. There is a great potential for groundwater use in the Mvoti to Mzimkulu WMA for rural water supply and accurate information is required. Groundwater could also be used in the stressed catchments such as the Mvoti to alleviate stress. Streamflow monitoring is undertaken on the major rivers of the WMA. There are several gauging stations used for streamflow monitoring, however, the accuracy and reliability of all these are not 100% although some are better than others. River systems like the Mvoti, Mtwalume, Mzimkulu and Mzumbe do not have a representative gauging network.

Water levels in all DWAF and Umgeni Water dams are monitored. Releases from the dams are also monitored. However, there is no monitoring of water levels or releases from farm dams, or if there is, this data is not readily available.

Abstractions made by irrigators from run-of-river are not monitored. There is therefore always uncertainty as to how much water irrigators actually use. It is also very difficult to control irrigation abstractions and implement restrictions in times of drought if the abstractions are not monitored.

Biomonitoring in the WMA is limited to the Mgeni River only.

Rainfall monitoring is reasonable, undertaken throughout the WMA. Rainfall stations are monitored by the Weather Bureau, private institutions, municipalities, DWAF and other Departments in the WMA. The ease of acquisition of rainfall data is reasonable from all institutions.

Municipalities monitor the quality and quantity of effluent discharges from their sewage treatment plants, with DWAF responsible for compliance monitoring.

Monitoring of the estuaries is insufficient. Information on inflows (quality and quantity) and water level fluctuations due to mouth closures is required.

There is no monitoring of wetlands. This is required to ensure the continued ecological functioning of the wetlands. Exactly what this monitoring might entail is debatable, but inflows and outflows (quantity and quality) and water levels would be a good start.

The number of farm dams in the WMA exceeds the registered number and the capacities of most farm dams have never been verified.

The small package sewage treatment plants in the Hillcrest area and along the coastal strip are not monitored. The local authorities are responsible for monitoring these.

STRATEGIC APPROACH	The Department of Water Affairs and Forestry seeks a strategy to: ▪ Improve monitoring networks so that the resource can be accurately quantified for allocations and management accounting purposes; ▪ Improve on efficiencies in the gathering of information, particularly through institutional co-operation in data capture and management; ▪ set and maintain standards for the capture, processing and management of information and ▪ ensure that data is accessible to stakeholders without compromising data security. Key elements of the strategy: • To motivate nationally regarding the importance of monitoring and the essential need for better networks at national, WMA, and catchment level. The strategy is to ensure that those responsible for the allocation of funding fully understand that to allocate, manage and sell water means that local managers need to know what and how much they have to allocate, manage and sell. Co-ordination and co-operation across agencies at a regional level are required. The good co-operation that exists in the Mvoti to Mzimukulu WMA needs to be maintained. • Organisational co-operation and efficiency. As an organisation DWAF can only operate at optimum efficiency through close co-operation and sharing of relevant data capture and information management with its partners. • Assessment of information requirements (surface water, groundwater etc) at the scale of decisions (WMA and at catchment scale). • Meetings and negotiations with co-operating partners. Assess what information is gathered, how it is processed and stored. Develop a plan for the sharing of mutually useful information. • Together with co-operating partners develop a set of principles which outline the basis for monitoring and information capture. Typically these could cover: accuracy, completeness, time scales and time frames, information sharing). • Prepare a set of standards for data capture and the processing of information. • Design a monitoring system to meet needs. This design should offer phased implementation, based on priorities. Priorities should be broken down to critical monitoring points within specific fields of concern, so that the most urgent areas can be attended to first. Apply the cost: benefit principle. • Motivate and seek funding to meet requirements. • Develop and train staff. • At regional level the implementation of this monitoring strategy will be tasked to a small team drawn from across the traditional hydrological disciplines in the region. • Dissemination of information to different communities across the WMA. • New water resources infrastructure developments should include the development of gauging stations as a requirement.

	The main areas of weakness with regard to monitoring that must be addressed are: • Monitoring of all abstractions, especially irrigation which is currently mostly not monitored. • Flow gauging in the Mvoti, Mzimkulu, Mtwalume and Mzumbe catchments. • Groundwater monitoring (water levels, abstraction rates, and quality). • Water quality discharge, especially in the smaller urban centres.

MANAGEMENT ACTION	**RESPONSIBILITY AND PRIORITY**
Install additional flows gauges in the Mvoti, Mzimkulu, Mtwalume and Mzumbe catchments.	Regional Office Priority: High
Initiate monitoring of all abstractions, with large abstractions receiving priority.	Regional Office Priority: High
Initiate monitoring of groundwater abstraction, starting with the regions where groundwater usage is the greatest.	Regional Office Priority: High
Develop a protocol for monitoring the discharge of small sewage plants and implement this through co-operative governance.	D: NWRP, Regional Office Priority: Medium
Develop a collaborative and co-operative relationship between DWAF and other organizations, as well as individuals that have monitoring networks, and develop a consolidated monitoring and information management strategy.	D: NWRP, Regional Office Priority: Medium
Secure funding and prioritise implementation.	D:NWRP Priority: High

GS5	POVERTY ERADICATION, EQUITY AND CO-OPERATIVE GOVERNANCE STRATEGY
MANAGEMENT OBJECTIVE	Contribute to poverty eradication and redressing of water allocation inequities in the Mvoti to Mzimkulu WMA.
SITUATION ASSESSMENT	Poverty eradication and inequity redress have been identified by the South African government as a priority and all organs of state are required to address these in a co-ordinated manner. The Department is co-operating with other departments to ensure that the management of water resources can contribute to the Integrated Rural Development Programme and the Urban Renewal Strategy, with particularly emphasis on interventions to eradicate poverty. One such co-operation has been the drafting of the National Guidelines for Integrated Management of Agricultural Water Use (NGIMAWU) by the Department of Agriculture. The guidelines entail a two-fold, stepped objective for the revitalisation of the agricultural water use sector, i.e: ▪ improved food security through own production (‘*food first’*), and ▪ mainstreaming historically disadvantaged farmers in the local, national and international economy through active support for business and market development. Several government departments have developed support mechanisms in favour of resource-poor farmers since the first South African democratic elections in 1994. However, the various departments each addresses only elements of the support requirements, with little co-ordination between them, leading to impaired implementation efforts. The challenge is to find streamlined mechanisms for co-ordination of effort. These mechanisms must contribute to the shift towards local government (District Councils) as the point of delivery. According to NGIMAWU, the mechanisms through which the key policy and strategy arenas can be co-ordinated should be sought. A wide range of support initiatives exist within the various line departments which enable funding to be released for various purposes that are broadly developmental and targeted at resource poor agriculture. These include: ▪ Financial support mechanisms at interdepartmental, departmental, community, project and production levels; ▪ Institutions and representation at all levels, encompassing both governmental and civil society stakeholders; and ▪ Staffing, capacity building and training. ▪ Promote the objectives of the National Constitution and the National Water Act in respect of achieving a more equitable distribution of agricultural water in the country; ▪ Lead to an increase in the number of previously disadvantaged individuals in profitable agricultural production; ▪ Lead to improved household food security, both in the context of schemes and more broadly as a result of non-scheme agricultural production, and both through increased own production of food and through increased income from agricultural activities; and ▪ Increase investment in vulnerable groups, such as women and youth. ▪ Infrastructure and agricultural input support of R200 to R3 000 per household administered through the Special Programme for Food Security, administered by the Department of Agriculture; ▪ A sliding-scale farm establishment subsidy offering between R20 000 and R100 000 as the beneficiary’s own contribution increases, as a start-up grant

- for farmers provided with land under the land restitution for agricultural development (LRAD) programme, or farmers wishing to directly purchase land. This programme is administered by the DLA;
- Capital subsidies for bulk water supply development by Water User Associations of up to R10 000 per hectare to a maximum of R50 000 per farmer, administered by DWAF;
- Individual irrigation equipment subsidies under the Irrigation Improvement Scheme of up to R7 500, administered by the PDA;
- Support for the development of Community Production Centres (CPCs) under the Community Based Public Works Programme, administered by PWD; and
- Support (both training and finance) for small, medium and micro enterprise development from the Department of Trade and Industry.

There are significant disparities within the WMA in terms of income, education and access to services, as is common in many parts of South Africa. The most impoverished areas are generally situated in rural parts of the WMA but certain peri-urban areas also have significant problems. The National Water Act dictates that addressing past inequities must be a primary consideration of the CMAs. In addition, it is relevant to note that the areas in question are often the most vulnerable with respect to water quality problems, the most susceptible to flooding, the least well endowed with safe sanitation (resulting in severe faecal pollution) and the most susceptible to poor agricultural practices. All of these facts emphasize the importance of these communities being represented on appropriate structures and also being the focus of significant upliftment and capacity building efforts.

Local and regional authorities are very active in trying to stimulate the local economy and significant advances have been made with the water supply infrastructure in recent years. Water for basic human needs has very limited impact on the total resource. However, the establishment of emerging farmers, has not yet been successfully implemented in the WMA and this will require significant volumes of water.

KwaZulu-Natal Province is generally marked by good co-operation at a provincial level although there are misgivings at the delays in decision-making due to too much consultation.

Water use authorisations and licences issued to date in the Mvoti to Mzimkulu WMA for in-basin requirements have not been to the previously disadvantaged individuals and communities. Established commercial farmers have benefited from almost all the allocations. The policy for water allocation in the WMA is hence to allocate or reserve all remaining available water to address inequity as a priority, following the Reserve requirements.

DWAF is further exploring its role in building capacity for productive water use through the DFID funded Water and Forestry Support Programme.

Land availability is sometimes the stumbling block to poverty eradication and inequity redress.

More and more emerging farmers have entered the sugarcane industry, benefiting from the competition legislation seeking to bar Illovo and Tongaat Hullett from controlling the entire production cycle by owning sugarcane farms, processing the cane in their mills and retailing sugar products.

STRATEGIC APPROACH	Where water is available for allocation in the WMA, this must be allocated for poverty alleviation and equity redress as a priority. This need not be large-scale irrigation projects but rather small-scale schemes to provide food security. Forestry and dryland sugar cane also offer opportunities for poverty eradication and use much less water than irrigation. The absence of initiatives to stimulate the productive use of water by the previously marginalized communities in the Mvoti to Mzimkulu WMA calls for a fresh view of the socio-economic factors affecting the water use by the rural poor. DWAF has initiated a cultural assessment to look at this issue in the country. There is a real potential to stimulate the economic development in the rural communities, especially within the Mlazi, Mkomazi, Mzimkulu and Mtamvuna catchments where significant water availability potential exists. The identification of poverty hot spots and areas where water can be made available without assessing socio-economic drivers will not be enough to stimulate productive water use. However, it should direct the stakeholders to areas of potential beneficiaries. The department has undertaken several studies to quantify water availability in the WMA, including this ISP. The information on the resources of the WMA should be pro-actively provided to other government Departments and agencies involved in servicing the needs of the population in the WMA. This could be achieved through the use of Co-ordinating Committees for Agricultural Water Use, WUAs, the Provincial Water Liaison Committee, IDP and WSDP processes. Funding requirements for poverty initiatives and inequity redress should be integrated. DWAF should advertise, through appropriate means, areas with excess water and call for resource poor farmers, previously disadvantaged individuals, and institutions involved in poverty eradication initiatives to apply for water allocations. A formalised plan making water available for poverty alleviation in stressed catchments needs to be put in place. Experienced members of the Regional Office do allocate water for this in stressed catchments like the Mgeni and the approach used needs to be formalised.

MANAGEMENT ACTIONS	**RESPONSIBILITY AND PRIORITY**
Pro-actively advertise areas suitable for poverty eradication initiatives and inequity redress initiatives based on water availability.	Regional Office Priority: High
Develop capacity building programmes for individuals, communities and WUAs for productive use of water	D WU Priority: High

<table>
<tr><td>GS6</td><td>INVASIVE ALIEN PLANTS STRATEGY</td></tr>
<tr><td>MANAGEMENT OBJECTIVE</td><td>To make more efficient use of the existing available water resources to all water user sectors by reducing unproductive water use by Invasive Alien Plants.</td></tr>
<tr><td>SITUATION ASSESSMENT</td><td>The situation with regard to invasive alien plants in the Mvoti to Mzimvubu WMA has been set out in the WMA report[5] , and is summarised below. The information is based on the report by Le Maitre et al[18].
<table>
<tr><th>Sub-area</th><th>Area of alien vegetation(km²)</th><th>Reduction in runoff (million m³/annum)</th><th>Reduction in yield (million m³/annum)</th></tr>
<tr><td>Mvoti</td><td>233</td><td>32</td><td>9</td></tr>
<tr><td>Mgeni</td><td>144</td><td>23</td><td>13</td></tr>
<tr><td>Mkomazi</td><td>44</td><td>11</td><td>1</td></tr>
<tr><td>Coastal</td><td>177</td><td>31</td><td>1</td></tr>
<tr><td>Umzimkulu</td><td>253</td><td>45</td><td>3</td></tr>
<tr><td>Total</td><td>851</td><td>142</td><td>27</td></tr>
</table>
The impact of invasive alien plants is only significant in the Mvoti and Mgeni sub-areas.</td></tr>
<tr><td>STRATEGIC APPROACH</td><td>The strategy in the Mvoti to Mzimkulu WMA should be to focus first on containment and secondly on eradication. The fact that infestation is, to date, relatively limited offers an opportunity for successful management but does not nullify the threat of future invasion. It is vitally important that this relatively favourable position of limited invasion be maintained.
There are a number of possible approaches to the clearing of invasive alien plants:
• In the first instance landowners should be held responsible for invasions on their own land and should be strongly encouraged to see to their removal. Landowners should also be held fully accountable for all invasions after 1998. However it is also recognised that the task of clearing all land is not always either possible or economically feasible and that either incentives or intervention by Working for Water or others may be required.
• In all catchments that are stressed or likely to move into deficit in the foreseeable future the approach should, first and foremost, be to encourage and make full use of Working for Water in the clearing of invasives. These are catchments that cannot afford to lose any more water and any water that can be reclaimed through the clearing of invasives will be welcomed in providing for the Reserve and in reducing the pressure on reallocations through Compulsory Licensing. In the case of the Mvoti to Mzimkulu WMA, the priority catchments for removal of alien vegetation are the Mgeni and Mvoti catchments.
Where catchments are in surplus, investment in the clearing of invasive alien plants by individuals and organisations in exchange for a water use licence may be considered and even encouraged. This would need to be on the basis of the principles of Water Use Exchange, which are currently being developed within the Department.</td></tr>
</table>

MANAGEMENT ACTIONS	RESPONSIBILITY AND PRIORITY
Investigate the real extent of invasive alien plants in the WMA, determine their impact on the resource, and develop a programme for removal. Priorities for removal include: (i) The riparian and dispersed invasions of *Acacia mearnsii* in the upper reaches of the Mgeni catchment – some of this has already been removed by Umgeni Water. These must first be contained and ultimately eliminated. This should go hand in hand with the community afforestation strategy to ensure that valuable firewood resources (e.g. the invasive *Acacia*) are not eliminated without other woodlots being established. (ii) The clearing of riparian and dispersed invasion in the Mvoti Key Area, especially upstream of Lake Merthley. Prioritise further action based on the WMA survey.	Responsibility: Regional Office Priority: Very High

GS7	IMPLEMENTATION STRATEGY
MANAGEMENT OBJECTIVE	To ensure that the approaches put forward by the Department through this ISP are adopted and implemented in the Mvoti to Mzimkulu WMA. This will require willpower, funding and capacity.
SITUATION ASSESSMENT	The ISP is an internal document developed by the Department of Water Affairs and Forestry. The ISP sets out the approaches which the Department is taking towards water management in the Mvoti to Mzimkulu WMA – and lists suggested actions towards achieving good management of the water resources. The wider public has had no direct input into the writing of this ISP – yet it is recognised that the approaches suggested have a significant impact on the people of the Mvoti to Mzimkulu WMA. Whilst the approach to date in developing this ISP may seem non-participatory, it must be remembered that this is not a Catchment Management Strategy – but DWAF setting out how it sees the situation, and the steps which it views as most appropriate in dealing with that situation. Interactions with the public have been an important influence in developing the approaches adopted. This ISP is not a closed document but is to be made available to the wider public for comment and input. This makes the ISP an inherently transparent document – opening out the thinking and planning of the Department. Although DWAF makes no commitment to adopt every comment made, these will be taken seriously and the ISP will be updated and improved as newer and better perspectives are formed. Once the CMA has been established it will be required to develop a CMS, and this will require full public participation. It is to be hoped that the ISP will be taken as useful baseline information and, indeed, that the approaches adopted here are found to be acceptable to, and adoptable by, the new dispensation.
STRATEGIC APPROACH	ISPs for each WMA are guided by the NWRS – and decisions affecting national resource distribution and use, as presented in the NWRS, are binding on each ISP. This ISP does, however, make a number of corrections and improvements which serve as knowledge updates to the NWRS, particularly as regards catchment water balances and the availability of water for purposes of allocation. The ISP is signed off by the Manager NWRP and approved by the Department's Water Resources Functional Management Committee. It is also published on the Departmental website. It therefore has the status of an official document containing current best available knowledge with regard to water resource use and availability. The ISP should be updated as and when new information becomes available and will serve as the primary source document for decision-making, within the framework provided by the NWRS. The implementation of the ISP is an enormous task and will have to be tackled in a stepwise fashion. Much of what is in this document describes the day-to-day functions of the Department – but there are many new tasks, functions, and actions set out in response to DWAF's visions for the future. It is recognised that it is quite impossible to immediately launch into, and achieve, all that is required by this ISP. Funds and capacity are real constraints. The approach is to take the ISP and to use it as instruction, guidance, and motivation in the development of yet clearer management and action plans. These must be built into Departmental Business Plans, and budgeted for as part of Departmental operating costs. This will necessarily be in a phased manner as dictated by available resources, but it is important that the ISP be used to leverage maximum funds, maximum capacity, and to bring optimum management to the WMA. The position with regard to the 'Authority of Information Contained in the ISP' is further set out in Para. 1.3.4 of Chapter 1 of this ISP document.

MANAGEMENT ACTIONS	RESPONSIBILITY AND PRIORITY
The following actions are required: • Publish the ISP to be accessible for public input and comment (consider hard-copy and web-based options). Copies will be presented to key stakeholders on request. It is not the intention to have a major drive for public input, but merely to create opportunity for input. • Develop materials which help to take the ISP to Provincial, District and Local Government authorities. Also to support the Water Services Development Plan, organised agriculture, emerging farmers, and others. Materials should be useful in preparation of the Provincial Growth and Development Strategy and other regional and provincial planning activities. • There are many actions in the ISP which do require public involvement – and it is important that the thinking with regard to, for example, the use of groundwater, and the importance of WC&DM, is delivered forcefully to local authorities, other direct water users such as agriculture, and the wider public. • Collate and consider all comment in revising and improving the ISP. The ISP should be open to continuous improvement, with updating on a regular/annual basis. • All Regional Office water resource management staff, Working for Water, Umgeni Water, local and district Municipalities, and other major stakeholders should have access to, or copies of, the ISP. • Approaches set out in the ISP need to be accepted and adopted by both national and regional staff. Where there is resistance to ideas then this needs to be resolved in an open climate of debate and understanding. Modification of the ISP is not ruled out. • The practicalities of implementation demands must always be considered. • Most actions in this ISP have been assigned to the Region. It is critically important that the tasks outlined are prioritised, budgeted for, and built into regional and national business plans and budgets.	Responsibility: Regional Office D: NWRP Priority: Very High

ANNEXURE A

Water sources for towns in the Mvoti to Mzimkulu WMA

Town/City	Existing Water Source	Possible future water source
Stanger	Mvoti River, Hazelmere Dam	Mvoti River, Hazelmere Dam
Greytown	Lake Merthley, Groundwater	Lake Merthley, Groundwater, Glen Dam
Pietermaritsburg	Midmar Dam	Mooi River
Durban/Pinetown	Albert Falls, Nagle and Inanda Dams	Mooi River, Mkomazi River
Howick	Midmar Dam	Midmar Dam
Richmond	BeaulieuDam	BeaulieuDam
Port Shepstone	Mzimkulu Rvier	Mzimkulu River
Margate	Mzimkulu Rvier	Mzimkulu Rvier
Port Edward	Mtamvuna River	Mtamvuna River
Craigieburn	Mkomazi River	Mkomazi River
Tongaat	Tongaat River	Tongaat River, Dudley Pringle Dam

ANNEXURE B

OPTIONS FOR AUGEMNTING THE WATER SUPPLY TO GREYTOWN

Development option	Incremental yield ($10^6 m^3/a$)	Unit reference value @ 8% (R/m^3)
Equip all current boreholes	0.12	R 0.15
Clear Lake Merthley riparian zone	0.29	R 0.29
6 new boreholes @ priority development area	0.38	R 0.66
Clear all timber in Lake Merthley Lake catchment	0.22	R 1.43
4 new boreholes @ Msipah	0.99	R 1.40
Construct proposed Glen dam	1.40	R2.97

ANNEXURE C

DAMS IN THE MVOTI TO MZIMKULU WMA

LOCATION	Name	Purpose	Full Supply Capacity	Full Supply Area
(Quaternary catchment)			million m3	km2
U10C	NETHERBY DAM NO. 3	Irrigation	0.05	0.02
U10C	SNOWHILL	Irrigation	0.25	0.12
U10C	THE DUFFRYN	Irrigation	0.10	0.03
U10D	LAURENS	Irrigation	0.30	0.10
U10D	MT. LE SEUER BIG	Irrigation	0.30	0.20
U10D	SOUTHDOWN	Irrigation	0.25	0.10
U10D	WATTLED CRANE	Irrigation	0.08	0.03
U10D	WHITE ROCKS	Irrigation	0.11	0.03
U10D	WINDEMERE	Irrigation	0.13	0.10
U10D	WUTHERING HEIGHTS	Irrigation	0.40	0.12
U10E	PAULHOLME	Irrigation	0.15	0.02
U10E	WATERMEAD	Irrigation	1.92	0.55
U10G	CALDERWOOD DAM (SEVEN STREAMS)	Irrigation	0.05	0.02
U10G	ELANDSHOEK	Irrigation	0.06	0.02
U10G	INHLUZANI RANCH	Irrigation	0.40	0.12
U10H	ALSACE DAM NO.1	Irrigation	0.05	0.02
U10H	ALSACE DAM NO.2	Irrigation	0.07	0.02
U10H	ALSACE DAM NO.3	Irrigation	0.12	0.03
U10H	CARRISMEADE BOTTOM	Irrigation	0.07	0.03
U10H	CARRISMEADE TOP	Irrigation	0.08	0.02
U10H	FAIRHAVEN	Irrigation	0.09	0.05
U10H	MACKENZIE	Irrigation	0.17	0.05
U10H	MAX LAKE	Irrigation	0.16	0.08
U10H	MZALANYONI IRRIGATION BOARD	Irrigation	0.80	0.08
U10H	NGODWENI	Leisure	1.95	0.71
U10H	ROCKFONTEIN	Irrigation	0.25	0.11
U10H	ROCKFONTEIN FOLOZI	Irrigation	0.22	0.11
U10H	WYARDS DAM NO. 2	Irrigation	0.07	0.03
U10J	GLENBAIN	Irrigation	0.11	0.03
U10J	GOOD HOPE DAM	Irrigation	0.06	0.03
U10J	MAYFIELDS	Irrigation	0.10	0.03
U10K	CHESTER	Irrigation	0.10	0.03
U10K	COPPINS	Irrigation	0.40	0.22
U10K	COPPINS FARM	Irrigation	0.40	0.22
U10K	HOME FARM	Irrigation	0.35	0.26
U10K	IBALA	Irrigation	0.09	0.03
U10K	LOCH BUIGHE DAM NO. 1	Irrigation	0.09	0.05
U10K	LOCH BUIGHE DAM NO. 2	Irrigation	0.12	0.06
U10K	MYHILL	Irrigation	0.12	0.03
U10K	NKOMANDENI	Irrigation	0.18	0.03
U10K	QWABALA DAM NO 1	Irrigation	0.12	0.04
U10K	QWABALA DAM NO 2	Irrigation	0.10	0.02
U10K	QWABALA DAM NO 3	Irrigation	0.12	0.02
U10K	ROELTON	Irrigation	0.10	0.03
U10K	SACRED HEART HOME STORAGE DAM	Irrigation	0.10	0.02
U10K	ST. ISADORE	Irrigation	3.00	0.55
U10M	GLENROSA FIELD DAM NO 2	Irrigation	0.08	0.01
U20A	BOVANA	Irrigation	0.06	0.04

U20A	CARIAD VACH	Irrigation	0.05	0.03
U20A	CROMERTY LOCH	Leisure	0.32	0.10
U20A	FARNINGHAM	Irrigation	0.20	0.09
U20A	FURTH	Irrigation	0.05	0.02
U20A	FURTH LOCH	Leisure	0.20	0.11
U20A	HASTINGS	Irrigation	0.19	0.08
U20A	HEATHERDON	Irrigation	0.05	0.02
U20A	HOUSE	Irrigation	0.05	0.03
U20A	INHLUZANI FISHING	Irrigation	0.23	0.08
U20A	INHLUZANI SMALL	Irrigation	0.05	0.03
U20A	KAMLOOPS	Irrigation	1.09	0.36
U20A	KIMBER BIG	Irrigation	0.66	0.25
U20A	KIMBERLEY	Irrigation	0.07	0.04
U20A	LYNDHURST LAKE	Leisure	2.04	0.84
U20A	MAVELA	Irrigation	0.10	0.03
U20A	RAINBOW	Irrigation	0.06	0.02
U20A	ROLDAN	Irrigation	0.06	0.03
U20A	SYNDICATE	Irrigation	0.12	0.04
U20A	TAIN LOCH	Leisure	0.11	0.04
U20A	TILLIETUDLEM	Irrigation	0.22	0.14
U20B	ALDORA	Irrigation	0.20	0.08
U20B	BEACON VLEI	Irrigation	0.65	0.20
U20B	BELLWOOD	Irrigation	0.17	0.06
U20B	BLESBERG	Irrigation	0.09	0.05
U20B	BLUE CRANE	Irrigation	0.14	0.05
U20B	BOSCHHOEK BIG	Irrigation	0.30	0.16
U20B	DR. ROOS J.	Irrigation	0.11	0.02
U20B	ELDERSLIE BOTTOM	Irrigation	0.08	0.03
U20B	GLAMOOR	Irrigation	0.18	0.10
U20B	GREENE'S	Irrigation	0.18	0.06
U20B	HOPEWELL	Irrigation	1.80	1.00
U20B	HOWARD	Information	0.18	0.07
U20B	MPUMULWANE LAKE	Irrigation	3.34	0.88
U20B	NUTBROOK	Irrigation	0.45	0.23
U20B	PINE TREE	Irrigation	0.06	0.01
U20B	RIETVALLI	Information	0.09	0.01
U20B	ROADSIDE	Irrigation	0.10	0.05
U20B	SPURWING	Irrigation	0.07	0.03
U20B	SURREY	Irrigation	2.50	0.10
U20B	WARSASH	Irrigation	0.09	0.03
U20B	WILLOWSTREAM	Irrigation	0.12	0.05
U20B	WINGFIELD	Irrigation	0.05	0.06
U20C	BROOKDALES	Irrigation	0.20	0.10
U20C	CORRIE LYNN	Irrigation	0.10	0.04
U20C	DARGLE	Irrigation	0.05	0.03
U20C	ELDERSLIE	Irrigation	0.08	0.02
U20C	ELDERSLIE DAM NO 14886	Irrigation	0.27	0.06
U20C	HOPEDALE	Leisure	0.07	0.04
U20C	MARITZDAAL	Irrigation	0.06	0.02
U20C	MIDMAR	Domestic Water Use	175.06	15.64
U20C	PETRUSSTROOM	Irrigation	0.10	0.06
U20C	RIETSPRUIT	Irrigation	0.06	0.02
U20C	RIETSPRUIT	Irrigation	0.12	0.06
U20C	SHERWOOD TOP	Irrigation	0.05	0.02

U20C	TELDARA	Irrigation	0.07	0.04
				6.26
U20D	ALDORA	Irrigation	0.24	0.06
U20D	ARLINGTON DAM NO 1	Irrigation	0.07	0.04
U20D	ARLINGTON DAM NO 2	Irrigation	0.06	0.03
U20D	ARLINGTON DAM NO 3	Irrigation	0.06	0.02
U20D	BLAIRMORE DAM NO. 1	Irrigation	0.08	0.02
U20D	BLAIRMORE DAM NO. 2	Irrigation	0.11	0.03
U20D	BLAIRMORE DAM NO. 3	Irrigation	0.25	0.08
U20D	GODWINI	Irrigation	0.06	0.02
U20D	HALLIWELL	Irrigation	0.23	0.05
U20D	KARKLOOF	Irrigation	0.10	0.03
U20D	KARKLOOF DAM C	Irrigation	0.07	0.02
U20D	KUSANE	Irrigation	1.00	0.15
U20D	LOSKOP FARM	Irrigation	0.06	0.02
U20D	MACKENZIE DAM NO.1	Irrigation	0.12	0.03
U20D	MANSFIELD	Irrigation	0.16	0.04
U20D	MONTEREY DAM NO 1	Irrigation	0.06	0.04
U20D	PATERIC	Irrigation	0.06	0.01
U20D	READ'S	Irrigation	0.25	0.09
U20D	SABI	Irrigation	0.05	0.03
U20D	SHAWSFLATS	Irrigation	0.08	0.07
U20D	SITEKA	Irrigation	0.15	0.06
U20D	TRIANDRA	Irrigation	0.06	0.03
U20E	ALBERT FALLS	Domestic water use	289.10	23.54
U20E	BARTERSFIELD DAM NO.1	Irrigation	0.16	0.04
U20E	BIG RED	Irrigation	0.30	0.05
U20E	BRAEMOORE	Irrigation	0.08	0.05
U20E	DEESIDE	Irrigation	0.54	0.18
U20E	DRY MOUNTAIN	Irrigation	0.06	0.01
U20E	DRY MOUNTAIN IRRIGATION	Irrigation	0.25	0.10
U20E	MOOIGEPIERD	Irrigation	0.07	0.02
U20E	MOOLMAN	Irrigation	0.07	0.07
U20E	ONGEGUND	Irrigation	0.05	0.02
U20E	PEATTIE'S LAKESIDE RESORT	Irrigation	0.39	0.13
U20E	POPLAR	Irrigation	0.09	0.02
U20E	TWEEBEEN	Irrigation	0.07	0.02
U20E	TWINS	Irrigation	0.08	0.06
U20E	WATERFORD	Irrigation	0.05	0.01
U20F	CHILTERN	Irrigation	0.11	0.03
U20F	CRAMOND SATELLITE	Irrigation	1.25	0.65
U20F	CRYSTAL LAKE	Irrigation	1.30	0.23
U20F	DOORNKOP DAM NO 1	Irrigation	0.25	0.09
U20F	DOORNKOP DAM NO 2	Irrigation	0.25	0.09
U20F	EVERGREEN	Irrigation	0.15	0.04
U20F	GRENCESTER	Irrigation	0.18	0.04
U20F	HOLME LODGE	Irrigation	0.25	0.11
U20F	IKHAMANZI DAM NO. 2	Irrigation	0.16	0.05
U20F	KLIPDRIFT	Irrigation	0.06	0.03
U20F	LAUGHTER	Irrigation	0.07	0.02
U20F	NEW BROOK	Irrigation	0.09	0.04
U20F	NEWINGTON	Irrigation	0.23	0.05
U20F	OAKVILLA LOWER	Irrigation	0.10	0.04
U20F	OAKVILLA UPPER	Irrigation	0.15	0.05

U20F	RAINBOW	Irrigation	0.05	0.01
U20F	WATERVAL	Irrigation	0.23	0.14
U20G	AASVOGELKRANS MIDDLE	Irrigation	0.08	0.04
U20G	AASVOGELKRANS TOP	Irrigation	0.11	0.04
U20G	CLARIDGE	Irrigation	0.12	0.02
U20G	DAIRY	Irrigation	0.06	0.03
U20G	DAVE'S	Irrigation	0.08	0.03
U20G	EDMONDS	Irrigation	0.11	0.03
U20G	GEORGENAU	Irrigation	0.27	0.06
U20G	JAHILE DAM NO. 3	Irrigation	0.06	0.02
U20G	MKABELO DAM NO 1	Irrigation	0.25	0.16
U20G	MKABELO DAM NO 2	Domestic Water Use	0.05	0.01
U20G	NAGLE DAM	Domestic Water Use	24.60	1.56
U20G	RIETSPRUIT	Irrigation	0.15	0.05
U20G	RIETSPRUIT DAM NO 1	Irrigation	0.06	0.01
U20G	SPRING VALLEY	Irrigation	0.17	0.05
U20G	SUNNYVALE	Irrigation	0.06	0.12
U20G	THORNHILL	Irrigation	0.10	0.04
U20G	VALLEY	Irrigation	0.15	0.05
U20G	WINDY HILL	Irrigation	0.05	0.02
U20H	HENLEY	Domestic Water Use	5.41	0.65
U20H	SAAL	Irrigation	0.27	0.11
U20H	TORING	Information	0.27	0.07
U20H	TUIN	Irrigation	0.06	0.03
U20J	BOULDER HILL MAIN	Irrigation	0.05	0.02
U20J	DARVILL ATTENUATION	Pollution	0.06	0.02
U20J	MAPSTONE	Irrigation	3.40	0.70
U20J	UITVLUG	Irrigation	0.31	0.06
U20L	INANDA	Domestic Water Use	251.64	14.63
U30A	HAZELMERE	Irrigation	17.86	1.81
U30C	ESIDUMBINI	Domestic Water Use	0.23	0.06
U30D	DUDLEY PRINGLE	Domestic Water Use	2.31	0.66
U30D	SYPHON	Domestic Water Use	0.36	0.16
U30E	CLAREMONT FARM	Irrigation	0.24	0.05
U30E	VLAKSPRUIT	Irrigation	0.06	0.01
U40A	AVALON	Irrigation	0.23	0.11
U40A	ERICA	Irrigation	0.25	0.07
U40A	KLAWERVLEI BOTTOM	Irrigation	0.15	0.03
U40A	MIDDLEDRIFT DAM	Irrigation	0.18	0.03
U40A	PROUDACRES	Irrigation	0.23	0.07
U40A	REDCLIFFE	Irrigation	0.22	0.05
U40A	RUSTENBURG	Irrigation	0.25	0.07
U40A	STOCKDALE	Irrigation	0.20	0.07
U40B	AUSSICHT	Irrigation	0.35	0.12
U40B	BRIDGEFORD	Irrigation	0.32	0.10
U40B	CHAILEY	Irrigation	0.06	0.01
U40B	DAD'S	Irrigation	0.10	0.04
U40B	FAIRFIELD	Irrigation	0.23	0.04
U40B	HAVENS REST	Irrigation	0.18	0.07
U40B	LAKE MERTHLEY	Domestic	1.98	0.90

		Water Use		
U40B	MISPAH ESTATE	Irrigation	0.05	0.02
U40B	OAKFORD	Irrigation	0.25	0.06
U40B	SUMMERFORD PARK	Irrigation	0.20	0.08
U40B	UMVOTIKLOOF	Irrigation	0.25	0.06
U40B	WEMBLEY	Irrigation	0.30	0.08
U40B	WEST END	Irrigation	1.90	0.40
U40B	WONDERBOOM	Irrigation	0.06	0.03
U40B	WOOLOOMOOLOO	Irrigation	0.37	0.16
U40C	ASHTON	Irrigation	0.16	0.06
U40C	EKAMANZI	Domestic Water Use	0.05	0.01
U40C	HARDEN HEIGHTS	Domestic Water Use	0.11	0.05
U40C	IKHAMANZI	Irrigation	0.05	0.01
U40C	IKHAMANZI DAM NO. 1	Irrigation	0.16	0.05
U40C	MBALANA	Irrigation	0.05	0.01
U40C	OEBISFELDE	Irrigation	0.25	0.12
U40C	VOGELVLEI	Domestic Water Use	0.43	0.17
U40E	FORBESDALE	Irrigation	0.16	0.05
U40F	ALLENDALE (HOME)	Irrigation	0.10	0.04
U40F	DEEP DENE	Irrigation	0.10	0.03
U40F	DOORNHOEK	Irrigation	0.17	0.04
U40F	HARMONIE	Irrigation	0.24	0.16
U40F	HAZYVIEW	Irrigation	0.16	0.05
U40F	HERMANNSBURG SCHOOL	Irrigation	0.25	0.10
U40F	KRANTZKOP	Irrigation	0.12	0.10
U40F	SUMMERFORD	Irrigation	1.70	0.85
U40J	KEARSNEY	Domestic Water Use	0.22	0.06
U50A	ASHDENE	Irrigation	0.15	0.05
U50A	COFFEE	Irrigation	0.12	0.03
U50A	SONDELA	Irrigation	0.25	0.03
U50A	SUGARLOAF	Irrigation	0.08	0.03
U60A	BAYNESFIELD	Irrigation	1.80	0.48
U60A	MBANGWENI	Irrigation	0.22	0.07
U60B	ALTON	Irrigation	0.11	0.03
U60B	BRASFORT DAM NO 1	Irrigation	0.19	0.06
U60B	COSMOORE BOTTOM	Irrigation	0.34	0.08
U60B	COSMOORE MAIN	Irrigation	0.80	0.15
U60B	COSMOORE TOP	Irrigation	0.12	0.03
U60B	DELECTABLE DALE DAM 1	Irrigation	0.15	0.05
U60B	DILEMMA	Irrigation	0.08	0.04
U60B	FAIRVIEW DAM NO 1	Irrigation	0.05	0.02
U60B	FAIRVIEW DAM NO 2	Irrigation	0.06	0.03
U60B	GLOWER OER	Irrigation	0.05	0.03
U60B	HIGHER SHALWYN TOP	Irrigation	0.09	0.02
U60B	IDLEWILD DAM NO 1	Irrigation	0.05	0.01
U60B	IDLEWILD DAM NO 2	Irrigation	0.05	0.02
U60B	IDLEWILD DAM NO 3	Irrigation	0.13	0.05
U60B	KWAJIKIJELA	Irrigation	1.20	0.42
U60B	LEEUWPOORT BOTTOM	Irrigation	0.07	0.04
U60B	LEEUWPOORT TOP	Irrigation	0.15	0.02
U60B	LILIEFONTEIN DAM NO 1	Irrigation	0.15	0.05
U60B	OORKANT-SE-	Irrigation	0.06	0.01

U60B	PHILPOT PLACE	Irrigation	0.07	0.03
U60B	POORTJIE DAM NO 1	Irrigation	0.05	0.02
U60B	POORTJIE DAM NO 2	Irrigation	0.05	0.02
U60B	THE FALLS	Irrigation	0.10	0.04
U60B	THORNER	Irrigation	0.23	0.05
U60B	THORNLEA	Irrigation	2.50	0.62
U60B	UMLAAS	Irrigation	0.40	0.15
U60B	UMLAAS PLAAS	Irrigation	0.68	0.10
U60B	VAALKOP	Irrigation	0.10	0.03
U60B	WOODLANDS	Irrigation	0.07	0.02
U60C	BASS LODGE	Irrigation	1.48	0.15
U60C	BOAVISTA	Irrigation	0.68	0.24
U60C	CAMPERDOWN	Irrigation	0.11	0.02
U60C	FAIRLEIGH	Irrigation	0.05	0.01
U60C	HAMMARSDALE	Irrigation	0.23	0.08
U60C	HONING KRANTZ	Irrigation	0.08	0.01
U60C	KILLARNEY	Irrigation	0.25	0.05
U60C	SANTA ROSE	Irrigation	0.05	0.01
U60C	WATER B	Irrigation	0.03	0.01
U60D	SHONGWENI	Domestic Water Use	4.50	0.57
U60E	ALOHA	Irrigation	1.10	0.18
U60E	CLONMEL DAM NO 1	Irrigation	0.11	0.04
U60E	CLONMEL DAM NO 2	Irrigation	0.27	0.07
U60E	CLONMEL DAM NO 3	Irrigation	0.28	0.06
U60E	POTSPRUIT	Irrigation	0.17	0.09
U60F	DURBAN MUNICIPALITY	Irrigation	0.65	0.18
U60F	SPRINGHAVEN	Irrigation	0.05	0.02
U70A	BEAULIEU	Irrigation	2.40	0.45
U70A	KEEROM DAM A	Irrigation	0.14	0.02
U70A	KEEROM DAM B	Irrigation	0.15	0.04
U70B	BLACK	Irrigation	0.13	0.05
U70B	COMMISSIE	Irrigation	0.06	0.04
U70B	GLENWOOD DAM NO 1	Irrigation	0.17	0.05
U70B	GLENWOOD DAM NO II	Irrigation	0.12	0.04
U70B	HARMONY TOP	Irrigation	0.06	0.03
U70B	KARLSHAVN	Irrigation	0.07	0.03
U70B	LASQUITI	Irrigation	0.06	0.02
U70B	LOVO DALE	Irrigation	0.09	0.04
U70B	MA CHAUMIERE DAM I	Irrigation	0.13	0.04
U70B	MA CHAUMIERE DAM NO. 2	Irrigation	0.05	0.02
U70B	RUGGED GLEN	Irrigation	0.05	0.03
U70B	THURLOW	Irrigation	0.08	0.03
U70C	ARNSIDE	Irrigation	0.09	0.01
U70C	ARTHUR LAKE	Irrigation	0.06	0.02
U70C	ELANDSFONTEIN-STRATHIELDSAYE	Irrigation	0.10	0.03
U70C	INGLEBROOK	Irrigation	0.34	0.06
U70C	MILFORD DAM NO 1	Leisure	0.07	0.02
U70C	NEWQUAY	Irrigation	0.06	0.02
U70C	STOKE STORAGE	Irrigation	0.16	0.05
U70C	STRATHFIELDSAYE	Irrigation	0.14	0.05
U70C	TORQUAY	Irrigation	0.06	0.06
U70D	NUNGWANA	Domestic Water Use	2.40	0.30
U70E	UMGABABA	Domestic	1.28	0.31

		Water Use		
U80A	INJAMBILI DAM NO. 1	Irrigation	0.10	0.05
U80A	INJAMBILI DAM NO. 2	Irrigation	0.16	0.05
U80A	THE VALLEYS	Irrigation	0.08	0.03
U80B	BALNAHARD BOTTOM	Irrigation	0.06	0.03
U80B	BALNAHARD TOP	Irrigation	0.34	0.09
U80B	GLENESK DAM NO. 2	Irrigation	0.09	0.02
U80D	BANANA	Irrigation	0.10	0.04
U80D	DAIRY	Irrigation	0.10	0.02
U80D	GREENWHICH	Irrigation	0.07	0.02
U80E	ESPERANZA DAM K2	Irrigation	0.06	0.02
U80E	ESPERANZA DAM K3	Irrigation	0.10	0.05
U80E	ESPERANZA DAM K6	Irrigation	0.08	0.02
U80E	LOCH HIGH RHONES	Irrigation	0.18	0.10
U80E	LOCH LOVEMORE	Irrigation	0.17	0.09
U80E	RYDAL DAM NO. 1	Irrigation	0.10	0.06
U80E	RYDAL DAM NO. 2	Irrigation	0.05	0.03
U80E	SUTHERLAND	Irrigation	0.10	0.06
U80E	UMTWALUMI FALLS	Irrigation	0.07	0.02
U80E	UMTWALUMI FALLS DAM NO 3	Irrigation	0.25	0.08
U80E	WILD ACRES	Irrigation	0.40	0.22
U80G	TANHURST ESTATE	Irrigation	0.08	0.03
U80H	E.J. SMITH DAM	Domestic Water Use	0.26	0.05
U80H	UMZINTO RIVER	Domestic Water Use	0.73	0.12
U80H	WATERS DAM NO 1	Irrigation	0.34	0.02
U80J	HIGHLYNN 5	Irrigation	0.13	0.05
U80K	WATERS DAM NO 2	Irrigation	0.06	0.02
T40D	BIZANA	Domestic Water Use	0.19	0.04
T40E	SMEDMORE	Irrigation	0.12	0.03
T40F	OUTLOOK	Irrigation	0.14	0.04
T40F	PITCHIN	Irrigation	0.07	0.01
T40G	BARRETT'S	Irrigation	0.09	0.05
T40G	BEEDALE	Irrigation	0.05	0.02
T40G	BRAIR GLEN	Irrigation	0.09	0.03
T40G	GREYSTONE	Irrigation	0.10	0.03
T40G	HIGHLAND GLEN	Irrigation	0.08	0.04
T40G	JACK WILLIAMSON	Irrigation	0.24	0.04
T40G	ROSELANDS	Irrigation	0.20	0.04
T51A	CASTLEBURN	Irrigation	0.24	0.08
T51A	DRAKENSBERG GARDENS	Irrigation	0.11	0.04
T51A	FONDELING	Irrigation	0.07	0.01
T51A	GLEN ELAND	Irrigation	0.25	0.20
T51A	NAVERONE LAKE	Irrigation	0.40	0.20
T51A	NICHOLSON TOP	Irrigation	0.23	0.10
T51B	BONSMA	Irrigation	0.65	0.40
T51B	CORRIE ANNAT	Irrigation	0.24	0.06
T51B	GOSCHEN	Irrigation	0.62	0.23
T51B	LAMINGTON DAM NO. 2	Irrigation	0.24	0.10
T51B	NICHOLSON MIDDLE	Irrigation	0.07	0.02
T51B	UTOPIA	Irrigation	1.25	0.99
T51C	BANAVIE	Irrigation	0.07	0.04
T51C	CLOVELLY DAM NO. 1	Irrigation	0.22	0.10

T51C	CLOVELLY DAM NO. 2	Irrigation	0.11	0.05
T51C	DARTFORD	Irrigation	0.15	0.11
T51C	KILMUN	Irrigation	0.11	0.04
T51C	LYNTON DAM NO 3	Irrigation	0.10	0.05
T51C	MONTROSE	Irrigation	0.08	0.04
T51C	SCOTTSTON	Irrigation	0.06	0.02
T51C	TRIANGE	Irrigation	0.78	0.34
T51C	TURNERS DAM NO. 1	Irrigation	0.05	0.02
T51D	DIEU DONNE 1	Irrigation	0.15	0.08
T51D	DIEU DONNE 2	Irrigation	0.25	0.09
T51D	DONNINGTON	Irrigation	0.50	0.35
T51D	GLENCAIRN	Leisure	3.20	0.55
T51D	GOXHILL	Irrigation	0.32	0.16
T51D	LIFTON	Irrigation	2.40	1.06
T51D	LYNTON DAM NO 1	Irrigation	0.08	0.03
T51D	ROADSIDE	Irrigation	0.09	0.05
T51D	ROY ALDOUS	Domestic Water Use	0.11	0.03
T51D	TIMBER	Irrigation	0.15	0.06
T51E	DIEU DONNE ESTATES	Irrigation	1.10	0.30
T51E	FINELANDS	Irrigation	0.18	0.10
T51E	HOLT	Irrigation	0.05	0.01
T51E	NORTH END	Irrigation	0.09	0.01
T51E	PEAKVALE	Irrigation	0.12	0.03
T51E	RINGSTEAD	Irrigation	0.25	0.14
T51F	ROUGHAM	Irrigation	0.10	0.03
T51G	CURRAGH LAKE	Irrigation	1.84	0.56
T51H	SINGIZI DAM - TRANSKEI	Industry	0.49	0.10
T52A	BEAUVALLET	Irrigation	0.06	0.02
T52A	BURNSIDE	Irrigation	0.35	0.20
T52A	CLERENWELL 7958	Irrigation	0.12	0.04
T52A	FAIRVIEW	Irrigation	0.18	0.03
T52A	TRAVELLER'S REST	Irrigation	0.18	0.03
T52K	AMANZIMNYANA	Domestic Water Use	0.66	0.11
T52K	MALTON DAM NO 1	Irrigation	0.17	0.03
T52K	RAVENHILL	Irrigation	0.17	0.03
T52K	UMZIMKULWANA	Irrigation	0.80	0.26
T52L	FAIRVIEW 1	Irrigation	0.10	0.04
T52L	GILBERT EYLES	Irrigation	0.34	0.25
T52L	KILDARE	Irrigation	0.20	0.10
T52L	THE FALLS	Irrigation	0.12	0.06

ANNEXURE D

Assumption made for the analyses carried out using the Water Resources Planning Model

Annexure D1: User Priority Classification

User priority classification (UPC) tables used for scenarios:

- Existing UPC table for 99% assurance of supply (5 scenarios)
- Adapted UPC table for 98% assurance of supply (5 scenarios)
- Current assurances of other users (e. irrigators, Reserve, etc.) remain unchanged

User Description	Demands at required risk or Risk i.t.o. recurrence interval (years) *Assurance of supply (%)*			
	1:200 *(99.5%)*	1:100 *(99.0%)*	1:50 *(98.0%)*	1:20 (95%)
CASE A (99.0%): – existing situation				
Wet industry	70	10	10	10
Dry industry	70	15	5	10
Domestic	40	20	20	20
CASE B (98.0%): – possible situation				
Wet industry	-	-	90	10
Dry industry	-	-	90	10
Domestic	10[Note]	-	70	20

Note: 10% of water for Basic Human Need has to be at 99.5% assurance of

Annexure D2: Summary of WRPM Results

Demand scenario	Required augmentation date (year)	
	99% assurance (A)	98% assurance (B)
1A and 1B: Base case – no WCDM	**2005**	**2006**
2A and 2B: Base case – 5% System use	**2006**	**2007**
3A and 3B: Base case – 5% eThekwini	**2006**	**2007**
4A and 4B: Base case – 10% System	**2006**	
5A and 5B: Base case – 10% eThekwini	**2006**	